PB90-154782

Superfund Record of Decision (EPA Region 2): Vineland Chemical Cumberland County, NJ. (First Remedial Action), September 1989

(U.S.) Environmental Protection Agency, Washington, DC

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16. Abstract (Limit: 200 words)

The Vineland Chemical site is in Vineland, Cumberland County, New Jersey. The site is in a residential/industrial area and borders the Blackwater Branch stream a tributary to the Maurice River, which ultimately flows into Union Lake. The Vineland facility consists of several herbicide manufacturing and storage facilities, a wastewater treatment facility, and several lagoons. The facility produces approximately 1,107 tons of herbicide waste by-product salts, EPA hazardous waste number K 031, each year which were stored onsite in uncontrolled piles on the soil, in the unlined lagoons, and in abandoned chicken coops. Furthermore, arsenic-contaminated wastewater was discharged into unlined lagoons until 1980 when Vineland Chemical Company began treating wastewater. Since 1978 hazardous waste salts produced at the site have no longer been stored onsite for more than 90 days and are disposed of offsite by licensed shippers; however, the past improper storage of those salts have resulted in extensive arsenic contamination of soil, sediment, and ground water because of the high solubility of the salts. The ground water underneath the plant discharges into the Blackwater Branch stream and has resulted in contamination of sediment in Blackwater Branch, the Maurice River, and Union Lake. The site has been divided into four discrete operable units to facilitate remediation: sediment in the 870-acre Union Lake; sediment in the Maurice (See Attached Sheet)

17. Document Analysis a. Descriptors
Record of Decision - Vineland Chemical, NJ
First Remedial Action
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Superfund Record of Decision:

Vineland Chemical, NJ

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EPA/ROD/R02-89/084
Vineland Chemical, NJ
First Remedial Action

16. Abstract (Continued)

River and Blackwater Branch stream areas; soil associated with the Vineland Chemical Company facility; and ground water underlying the site. The primary contaminant of concern affecting the soil, sediment, and ground water is arsenic.

The selected remedial actions for this site will be implemented in four discrete operable units (OUs). OU 1, the plant site source control, will include in situ flushing of 126,000 cubic yards of arsenic-contaminated soil, 54,000 cubic yards of which will be excavated and consolidated with 72,000 cubic yards of undisturbed soil; decontaminating onsite storage buildings (chicken coops); and closing two impoundments followed by offsite treatment and disposal of the wastewater and sludge recovered from the impoundments. OU 2, the plant site ground water, will include ground water pumping and treatment followed either by reinjection, offsite discharge to the Maurice River, or reuse for soil flushing; and offsite treatment and disposal of residue sludge from ground water treatment. OU 3, the stream and river areas sediment, will include excavating, dredging, and treating 62,600 cubic yards of exposed and buried sediment from the Blackwater Branch and its floodplain using water wash extraction followed by onsite redeposition of treated sediment; treating and offsite disposal of sludge residue from the water wash extraction process; implementing a three-year period of natural river flushing for the Maurice River sediment after remediating the arsenic-contaminated ground water; and selection of a water wash contingent remedy for the river sediments if levels persist above action levels. OU 4, an interim remedy for the Union Lake sediment, will include dredging, excavating, and treating sediment from Union Lake using water wash extraction followed by redeposition into the lake; treating and disposing of sludge residue offsite; and sediment and surface water monitoring. The estimated present worth cost for these remedial actions is $66,384,636, which includes estimated annual O&M costs of $3,463,463 for the short term and $38,010 for the long term for the plant source control, stream and river sediment, and lake sediment operable units; and a present worth O&M cost of $5,155,053 for the ground water operable unit.

DECLARATION STATEMENT

RECORD OF DECISION

Vineland Chemical Company

Site Name and Location

Vineland Chemical Company, Vineland, Cumberland County,
New Jersey

Statement of Basis and Purpose

This decision document presents the selected remedial action for the Vineland Chemical Company site, developed in accordance with the Comprehensive Environmental Response, Compensation and Liability Act, as amended by the Superfund Amendments and Reauthorization Act and, to the extent applicable, the National Contingency Plan. This decision is based on the administrative record file for this site.

The State of New Jersey has concurred with the selected remedy.

Assessment of the Site

Actual or threatened releases of hazardous substances from the site, if not addressed by implementing the response actions selected in this Record of Decision, may present an existing or potential threat to public health, welfare, or the environment.

Description of Selected Remedy

The remedial actions selected in this document represent permanent solutions for three portions of the site including the contaminated plant site soil, the contaminated groundwater in the underlying aquifer, and the exposed and submerged contaminated sediments in Blackwater Branch and the Maurice River. In addition, an interim remedy is presented for the fourth portion, which addresses the contaminated sediments in Union Lake.

The remedial actions, which will be implemented in phases or operable units, consist of the following:

Operable Unit One (Plant Site Source Control)

- o In situ treatment, by flushing, of the arsenic-contaminated soils to reduce arsenic levels. Portions of the contaminated soil will be excavated and consolidated prior to the flushing action.

- Plant site remediation also includes closure of the two lined surface impoundments in compliance with the Resource Conservation and Recovery Act (RCRA), and decontamination of the former chicken coop storage buildings.

Operable Unit Two (Plant Site Management of Migration)

- Removal of arsenic-contaminated groundwater through pumping, followed by on-site treatment and reinjection of the treated groundwater to the aquifer at the maximum rate practicable. The remainder of the treated groundwater will be discharged to the Maurice River. A portion of the treated groundwater will also be used for the soil flushing action in Operable Unit One. The arsenic-contaminated sludge from the groundwater treatment process will be transported off-site for hazardous waste treatment and disposal. This action will effectively eliminate the source of arsenic into the Maurice River system.

Operable Unit Three (River Areas Sediments)

- Excavation and treatment of the exposed arsenic-contaminated sediments in the Blackwater Branch floodplain. Treatment will consist of a water wash extraction. The cleaned sediments will be redeposited in the excavated portion of the floodplain. The sludge from the extraction process will be transported off-site for hazardous waste treatment and disposal. Remediation will begin after the contaminated groundwater flow into the Blackwater Branch has been stopped.

- Dredging/removal and treatment, by water wash extraction, of the submerged arsenic-contaminated sediments in the Blackwater Branch adjacent to and downstream of the Vineland Chemical Company plant site. Prior to removing any sediments, an environmental assessment of the impact of dredging will be performed and a confirmation made that these sediments are a source of contamination to the river system. The treated sediments will be redeposited on undeveloped areas of the Vineland Chemical Company plant site. The sludge from the extraction process will be transported off-site for hazardous waste treatment and disposal.

- After stopping the flow of arsenic-contaminated groundwater from the Vineland Chemical Company plant site, a three year period for natural river flushing will be implemented. This will allow the submerged, arsenic-contaminated sediments in the Maurice River to be flushed clean through natural processes. If, after this period, the submerged sediments are no longer contaminated with arsenic above the action level, no remediation will be performed in the river.

Similarly, if sediment contamination above the action level persists, but the observed or expected natural decontamination rate is consistent with an acceptable public health risk, no remediation will be performed. However, if contamination above the action level persists in some locations and is expected to remain at levels posing unacceptable health risks, those locations would be remediated.

- Remediation of the submerged Maurice River sediments will be performed, as necessary, by dredging and treatment with a water wash extraction. However, prior to removing any sediments, an environmental assessment of the impacts of dredging will be made. The treated sediments will be deposited on undeveloped areas of the Vineland Chemical Company plant site. The sludge from the extraction process will be transported off-site for hazardous waste treatment and disposal.

Operable Unit Four (Union Lake Sediments)

- Removal and treatment of arsenic-contaminated sediments on the periphery of Union Lake will be performed after the three year flushing period (if no remediation is performed in the Maurice River) or after remediation of the Maurice River (if this is necessary following the flushing period). Verification sampling will be conducted prior to remediation to confirm the locations of sediments contaminated above the action level for arsenic along the periphery of Union Lake.

- The arsenic-contaminated sediments on the periphery of Union Lake will be excavated after they are exposed by lowering the lake's water level. However, for the upper end of the lake above the submerged dam, prior to removing any sediments, an environmental assessment of the impact of dredging will be performed. The sediments will be treated by water wash extraction and the cleaned sediments returned to their approximate former locations in Union Lake. The sludge from the extraction process will be transported off-site for hazardous waste treatment and disposal.

- This is an interim remedy, since arsenic-contaminated sediments above health-based levels will remain in Union Lake. Therefore, periodic reviews will be conducted to determine whether contaminated sediments are redistributed, through natural processes, to the cleaned areas.

Statutory Determinations

The selected remedies for Operable Units One, Two and Three are protective of human health and the environment, comply with Federal and State requirements that are legally applicable or relevant and appropriate to these remedial actions, and are cost-effective. These remedies utilize permanent solutions and alternative treatment technologies to the maximum extent practicable and satisfy the statutory preference for remedies that employ treatment that reduces toxicity, mobility, or volume as a principal element. Because these remedies will not result in hazardous substances remaining on-site above health-based levels, the five year review will not apply to these actions.

The selected remedy for Operable Unit Four is an interim remedy which protects human health and provides for further monitoring and study to determine the scope and nature of any additional actions which may be necessary. The supplemental study will address the dynamics of sediment transport to, within, and from Union Lake, and will deal with the effect of arsenic on biota. This interim remedy will meet all of the statutory preference criteria, with the exception of permanence.

Because the remedy for Operable Unit Four will result in hazardous substances remaining in Union Lake above health-based levels, a review will be conducted within five years after commencement of remedial action at the lake to ensure that the remedy continues to provide adequate protection of human health and the environment.

William J

William J. Muszynski, P.E.
Acting Regional Administrator

9/28/89
Date

DECISION SUMMARY

Vineland Chemical Company Site

Vineland, New Jersey

SITE DESCRIPTION

The Vineland Chemical Company plant site is located in a residential/industrial area in the northwest corner of the City of Vineland in Cumberland County, New Jersey. The plant location is shown in Figure 1. The Vineland Chemical Company has produced organic herbicides and fungicides at this location since 1949.

The herbicide manufacturing process reportedly has produced approximately 1,107 tons of waste by-product salts each year. These wastes have an Environmental Protection Agency (EPA) hazardous waste number of K 031 and are presently neither treated nor disposed of at the site, and are not stored on-site for more than 90 days. The salts are transported by licensed shippers to licensed facilities in Ohio and Michigan for disposal. In the past, improper storage of these salts on the plant property led to arsenic contamination in the soil and groundwater.

The Vineland Chemical Company site is ranked among the top ten hazardous waste sites in New Jersey, and is ranked number 42 on the National Priorities List. Arsenic contamination, attributable to the Vineland Chemical Company, has been detected in the soils and groundwater at the plant site, and has been detected in surface waters and sediments as far as 36 miles downstream from the plant.

The plant site is shown in Figure 2. The plant consists of several manufacturing and storage buildings, a laboratory, a worker change facility, a wastewater treatment plant and several lagoons. The manufacturing and parking areas shown in Figure 2 are paved. The lagoon area is unpaved and is devoid of vegetation. This area is characterized by loose sandy soils. The remainder of the site is covered by trees, grass, or shrubs.

The site is situated in a residential/industrial area. Twelve residences are shown in Figure 2 in the immediate vicinity of the plant. A number of other residences are located close to the plant along Wheat, Orchard, Oak, and North Mill Roads.

The Blackwater Branch is immediately north of the plant site. This stream flows east to west and discharges into the Maurice River approximately 1.5 river miles downstream from the plant. The upper Maurice River flows approximately 7 river miles downstream into Union Lake, which is approximately 2 miles long. The Maurice River then flows approximately 25 river miles downstream from the lake into the Delaware Bay.

Some time between April 1985 and June 1986, beavers constructed a dam on the Blackwater Branch just downstream from the North Mill Road bridge. The dam flooded the Blackwater Branch to the approximate extent shown in Figure 2. The dam was removed in October 1987 to allow for construction of a new bridge. The Blackwater Branch is now flowing in its normal channel and the flooded areas are now exposed.

Union Lake is located in the city of Millville, New Jersey. In the past, the lake had been used extensively for recreational activities. The dam at the southern end of the lake is the oldest in the state, and the spillway is currently being rebuilt. During reconstruction, the water level of the lake has been lowered approximately eight to nine feet.

Because of the potential health risks posed by exposure to arsenic contamination in the lake sediments, recreational activities in the lake have been restricted by the NJDEP during the drawdown condition.

Reconstruction is expected to be completed by late fall of 1989, at which time the lake will be allowed to refill. Once refilled, the NJDEP plans to partially reopen the lake to boating and fishing. Complete lake reopening to include swimming will depend on the results of a sediment testing program planned by the NJDEP.

SITE HISTORY

As early as 1966, the New Jersey Department of Environmental Protection (NJDEP) observed Vineland Chemical discharging untreated wastewater with unacceptable arsenic concentrations (67 milligrams per liter (mg/l)) into the unlined lagoons. An unknown quantity of arsenic rapidly percolated to the groundwater from the lagoons. On February 8, 1971, Vineland Chemical was ordered to install and provide industrial wastewater treatment and/or disposal facilities. The wastewater treatment works did not become operational until March 1980.

Waste salts from the herbicide production process were stored on-site in uncontrolled piles on the soil, in the concrete lagoon LL-2 (which at the time was unlined), and in abandoned chicken coops on the plant property. The storage of salts in piles was observed in April 1970 and in the coops in April 1973. It was not until 1978 after issuance of a court order that the salts were containerized and removed. These salts reportedly contained one to two percent arsenic (RCRA Part B Permit Application by Vineland Chemical Company, 1980). As these salts have a high solubility, precipitation contacting these piles rapidly dissolved the salts and carried an unknown quantity of arsenic into the groundwater.

Between 1975 and 1976, the Vineland Chemical Company was fixating the waste salts for disposal at the Kin-Buc Landfill. The process involved mixing the dried salts with ferric chloride and soda ash, reportedly reducing the solubility. The process was stopped in 1976 when the Kin-Buc Landfill voluntarily stopped accepting all chemical wastes, including the fixated salts. Vineland Chemical then resumed piling the untreated waste salts on the soil surface at the plant site.

A court order issued on January 26, 1977 required Vineland Chemical to containerize the waste salts from the chicken coops and piles, and then store the drums in a warehouse off-site. In June 1979, another order was issued for the disposal of the stored drums at an approved landfill. Removal and disposal of these drums was not completed until June 30, 1982.

Currently, the waste salts and the sludge from the wastewater treatment systems are stored in large-capacity trailers and tote bins. The tote bins are filled at the point of generation in the manufacturing buildings, and then emptied into the trailers. The salts and sludge are transported to licensed facilities, as mentioned previously. During peak production, as many as four or five trailers were filled and removed per week.

Aerial photographs provided by the EPA's Environmental Photographic Information Center (EPIC) and other investigations suggested several possible locations of past contamination. The cleared area in the southwest corner of the site shown as a "former outdoor storage area" in Figure 2 was at one time occupied by two chicken coops. Sometime between November 1975 and March 1979, both coops were destroyed. These coops were reportedly used to store process chemicals and/or waste. The materials stored in the coops may have percolated into the groundwater. This area is now devoid of vegetation. Photographs also show many other locations containing mounded material and/or drums. These include the lagoon area and locations along the plant road. The waste salts were reportedly mounded so high at times in Lagoon LL-2 that the salts spilled over onto the soil near the lagoon.

It was alleged that the floors of the manufacturing plant leaked arsenic compounds into the underlying sands. The original floors were brick and were reported in need of repairs several years ago. Allegedly, when the old bricks were removed, the soil contained crystalline wastes from previous spills. It is not known whether any soil was removed when the floors were replaced. In the Remedial Investigation and Feasibility Study (RI/FS), the soils below building #9 were sampled and had high arsenic concentrations.

In response to a series of Administrative Consent Orders issued by the NJDEP, Vineland Chemical instituted some cleanup actions and modified the production process. The cleanup actions included stripping the surface soils in the manufacturing area, piling these soils in the clearing by well cluster EW-15, and paving the manufacturing area; installing a storm water runoff collection system; removing the piles of waste salts; and installing a groundwater pumping and treatment system, which included the wastewater treatment plant. Modifications to the production process included installing a water system where mixing of process water and non-contact cooling water was unlikely, lining two of the lagoons used in the wastewater treatment system (LL-1 and LL-2), and properly disposing of the waste salts.

PREVIOUS INVESTIGATIONS

Since 1978, a number of studies have been performed by or for the NJDEP Office of Science and Research in the Maurice River watershed and at the Vineland Chemical Company plant site. The Vineland Chemical Company itself has also conducted some investigations into the groundwater plume at the plant. A detailed discussion of these investigations is provided in the RI/FS reports. These investigations are summarized in Table 1.

ENFORCEMENT ACTIVITIES

Potentially responsible parties (PRPs) identified for the site include the Vineland Chemical Company and its owners. EPA signed an Administrative Consent Order with the Vineland Chemical Company on September 28, 1984 allowing the company to conduct a remedial investigation of the site pursuant to the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA). Vineland Chemical submitted RI/FS Work Plan drafts which required major revisions. Vineland Chemical failed to submit a draft Work Plan incorporating the modifications required by EPA by April 17, 1986. EPA granted Vineland Chemical additional time until May 6, 1986, but the revised Work Plan was not submitted in a timely manner. EPA assumed responsibility for the RI/FS on May 8, 1986. EPA's RI/FS is summarized in this Record of Decision (ROD) and serves as the basis for the selected remedy for the site. After the RI/FS was completed, a 30-day public comment period was provided, ending on August 1, 1989.

EPA determined that the Vineland Chemical Company could not effectively undertake the preliminary remedial investigation work; the company will not be given the option to perform the remedial design work. EPA expects to use its enforcement authority to assure that the PRPs fund the remedial work to the maximum extent possible.

COMMUNITY RELATIONS ACTIVITIES

A Community Relations Plan was developed for the site. The plan lists contacts and interested parties in government and the local community. It also establishes communication pathways to ensure timely dissemination of information.

EPA finalized the Work Plan for the RI/FS in November 1986 and placed this document in the three information repositories. A public meeting was held on December 8, 1986 to discuss the Work Plan for the RI/FS and to inform the public about the Superfund program and the history and status of the site.

The RI/FS reports and Proposed Plan for the Vineland Chemical Company site were released to the public in June 1989. These documents were made available to the public in both the administrative record and in information repositories maintained at the EPA Docket Room in Region II, Millville City Hall, and Vineland City Hall, and the public libraries of Millville and Vineland. The Notice of Availability for these documents was published in The Daily Journal. A public comment period was held from July 1, 1989 through August 1, 1989. In addition, a public meeting was held on July 18, 1989, followed by a public availability session on July 19, 1989. At these meetings, representatives from EPA answered questions about problems at the site and the remedial alternatives under consideration. The responses to the comments received during this period are included in the Responsiveness Summary at the end of this ROD.

SUMMARY OF SITE CHARACTERISTICS

The RI/FS encompassed the areal extent of the contamination in a study area approximately 38 miles long with several sub-areas, including:

- The Vineland Chemical Company plant site;
- The River Areas, consisting of the Blackwater Branch, the upper Maurice River between the Blackwater Branch and Union Lake, and the lower Maurice River between Union Lake and the Delaware Bay; and
- Union Lake, an 870-acre impoundment on the Maurice River.

Table 2 presents the areas studied and the dates that the final draft RI and FS reports were submitted for public review. The following discussion summarizes the characteristics within the three sub-areas. The RI/FS reports provide the complete details of, and the supporting documentation for, the summaries provided below.

o Vineland Chemical Company Plant Site

Table 3 shows contaminants detected in the soils. Figure 3 shows the arsenic concentrations at the sampling nodes.

Approximately 126,000 cubic yards of soil above the water table is contaminated with arsenic concentrations above the action level of 20 milligrams per kilogram (mg/kg), with concentrations as high as 650 mg/kg. Contamination was found in areas where arsenic was known or suspected to have been improperly stored or dumped on the soils in the past.

Off-site soil arsenic concentrations are very low to undetected. On-site soils in areas with no manufacturing history have low to undetected arsenic concentrations. These data indicate that there has been very little to no surface migration of soil contamination.

The soils below Building #9 have very high arsenic concentrations. This is a process building where crystalline arsenic wastes were reportedly observed on the ground in the past. This indicates that further arsenic contamination may be present underneath some of the paved manufacturing area.

The dust samples taken from the chicken coops had high concentrations of arsenic, cadmium, lead, mercury, and zinc, as shown in Table 4. All of these metals, except possibly zinc, were used in the past for manufacturing herbicides.

The groundwater underneath the site is heavily contaminated with arsenic. Figure 4 shows the plume beneath the plant site. The contamination is restricted to the upper aquifer, identified as the upper sand, that overlies a banded clay zone approximately 40 to 50 feet below the ground surface. Below the banded zone, arsenic was detected infrequently and at very low levels (highest concentration was 28 micrograms per liter (ug/l)). Most of the deep well samples contained no detectable arsenic.

Cadmium contamination was also observed in the groundwater in the upper sand. The cadmium plume is in the same general location as the arsenic plume. Although cadmium was found in the groundwater, it was not found in the soils. Trichloroethylene (TCE) and lead were also found in the groundwater. Pesticides were detected in monitoring wells at all depths. Table 5 presents a summary of the contaminants detected in the groundwater.

The groundwater from underneath the plant site discharges into the Blackwater Branch. The present-day input of arsenic into the groundwater from the plant site soils was estimated to be between 0.02 and 0.12 metric tons per year, while approximately six metric tons of arsenic per year enters the Blackwater Branch with the groundwater discharge. This indicates that the arsenic entering the Blackwater Branch is probably the result of past contamination.

o River Areas

Tables 6 and 7 present summaries of the contaminants detected in the surface water and sediment within the river areas, respectively. Figures 5, 6, and 7 show the sediment arsenic concentrations in the top one foot of sediment for sampling stations in the Blackwater Branch, the upper Maurice River and the lower Maurice River, respectively.

The main contaminant of concern is arsenic. Arsenic concentrations in the sediment and surface water in the Blackwater Branch are low to undetected upstream of the Vineland Chemical Company plant site, and are elevated downstream of the site. Similarly, arsenic concentrations in the sediment and surface water of the Maurice River are low to undetected above this river's confluence with the Blackwater Branch, and are elevated below the confluence. All of the tributaries to the Maurice River between the Blackwater Branch and Union Lake show very low to undetected arsenic concentrations. These data show that the Vineland Chemical Company plant is the only significant source of arsenic to the Maurice River drainage basin between the plant and Union Lake.

The highest surface water arsenic concentration (over 6000 ug/l) was observed in the area previously flooded because of a beaver dam on the Blackwater Branch. The flooded area was directly adjacent to the Vineland Chemical Company plant site and in the direction of the arsenic-contaminated groundwater plume. This area was drained by the Cumberland County Public Works Department, which removed the beaver dam since the sampling took place to facilitate the construction of a new bridge on Mill Road.

The arsenic concentration in the upper Maurice River surface water decreases progressively downstream from the Vineland Chemical Company site. The arsenic concentration does not drop below 50 ug/l, the New Jersey surface water standard for arsenic, within this portion of the river. The arsenic concentration in the lower Maurice River surface water decreases gradually downstream from Union Lake until the tidal front is encountered. The total arsenic concentration does not drop below 50 ug/l until approximately 21 river miles downstream from the Vineland Chemical Company plant site based on the 1987 RI/FS data. In the 1979 sampling performed by the NJDEP, the total arsenic concentration in the surface water did not drop below 50 ug/l until approximately 26.5 river miles downstream from the site.

Based on samples collected by the Vineland Chemical Company at North Mill Road, an estimated 500 metric tons of arsenic have been transported past North Mill Road into the Blackwater Branch and upper Maurice River.

Unlike the surface waters, there is no clear pattern of arsenic distribution areally in the Maurice River sediments. In some cases, higher concentrations were observed further downstream than upstream. The sediment arsenic distribution is more likely controlled by the chemical partitioning of arsenic between water and fine grain sized material, and by the local sediment deposition rate, than by strict distance downstream from the site.

Arsenic concentrations in the sediments positively correlated with total organic carbon content, iron content and percent clay. These data suggest that arsenic is bound to the sediments via organic carbon and ferric hydroxide matrices which coat the finer sediments fractions. Leach tests of Union Lake sediments showed that 50 to 70 percent of the sediment bound arsenic is not easily extractable. The fraction retained correlates positively with percent organic matter.

The three river sections were examined to determine their influence on the arsenic load in the drainage basin. The Blackwater Branch and upper Maurice River appear to be simple conduits for arsenic released from the site, that is, they pass the arsenic released from the site into Union Lake. The data were unclear on whether Union Lake is a conduit or a sink for arsenic flow. In the past Union Lake has been a major sink for arsenic, since an estimated one-third (140 metric tons) of the arsenic released from the site through time has been captured in the lake sediments. An insufficient data base exists to reliably quantify the sediment arsenic inventory in the lower Maurice River, although sediment arsenic contamination is present in this section of the river. Any arsenic entering the lower river and not adsorbed onto the sediments is presumably transported to Delaware Bay.

Future arsenic levels were predicted assuming the arsenic flux to the basin from the site was halted. The level of water-borne arsenic in the upper Maurice River and the Blackwater Branch should drop shortly after the source of arsenic from the plant site is eliminated. There is a low inventory of arsenic in the sediments in this portion of the river, which presently behaves as a conduit. Since it is not clear what is controlling the water column arsenic inventory in Union Lake at present, it is difficult to predict how rapidly lake arsenic levels will decrease. The water column arsenic levels in the lower Maurice River are dependent upon lake arsenic levels.

No pesticides/PCBs were found in fish samples taken from the upper Maurice River. However, arsenic was detected in one of the fish samples from the upper Maurice River, and in crab and oyster samples from the lower river. Arsenic was not detected in fish samples from the lower Maurice River. The detected concentrations are within the range of normal background levels in fish and shellfish.

The USEPA's Environmental Response Team prepared a bioassessment on the Blackwater Branch and the upper Maurice River. The report concluded that there was an adverse impact to the benthic communities in the Blackwater Branch downstream from the Vineland Chemical Company plant site. The impact took the form of lower species diversity and a toxic response in bioassay tests done with the sediments. The impact lessens in the Maurice River, probably resulting from dilution.

o Union Lake

The only hazardous substance of concern in the lake sediments and water is arsenic. Arsenic concentrations above 50 ug/l were found in many water samples. Arsenic concentrations above 20 mg/kg were found in many sediment samples.

Table 8 summarizes the concentration ranges of arsenic in water samples. The arsenic concentrations were higher in the summer and early fall than in the winter in many of the studies performed to date. In general the dissolved arsenic concentrations are uniform throughout the water column. Particulate and/or total aqueous arsenic concentrations tended to be higher in water samples taken at the sediment/water interface.

Table 9 summarizes the concentration ranges of arsenic levels in the sediments, which are presented in Figure 8. The maximum sediment arsenic concentration from the RI/FS's Phase I sampling was 107 mg/kg. Previous NJDEP investigations found sediment arsenic concentrations as high as 1273 mg/kg. The arsenic contamination was generally restricted to the top one foot of sediment. The highest concentrations were generally found near the submerged dam in the northern portion of the lake and adjacent to the main dam in the southern portion of the lake.

Fish samples were obtained from three different locations in the lake. Five separate species were caught and analyzed. The analytical results showed that the fish contained arsenic at the normal concentration for U.S. fish and shellfish. The fish also contained chlordane, DDE, and PCB 1260 at concentrations of less than 1 mg/kg.

SUMMARY OF SITE RISKS

The potential health risks caused by exposure to contaminated media were calculated. A general discussion of the methods used to assess these risks is presented below, followed by a discussion of possible health risks posed by each of the sub-areas within the study area. The risk assessments for each of these sub-areas are presented in the RI reports.

A risk assessment involves determining possible routes of human exposure to contaminated media (air, water, soil) at a site, then estimating possible intake levels. Contaminants within those media are determined. The toxicological properties of those contaminants are then evaluated. Finally, semi-quantitative estimates of potential health risks are determined using the potential routes of exposure, contaminants of concern, and the toxicological properties of those contaminants.

Cancer potency factors (CPFs) have been developed by EPA's Carcinogenic Assessment Group for estimating excess lifetime cancer risks associated with exposure to potentially carcinogenic chemicals. CPFs are multiplied by the estimated intake of a potential carcinogen to provide an upper-bound estimate of the excess lifetime cancer risk associated with exposure at that intake level. The term "upper-bound" reflects a cautious estimate of the risks calculated from the CPF. Use of this approach makes underestimation of the actual cancer risk highly unlikely. Cancer potency factors are derived from the results of human epidemiological studies or chronic animal bioassays to which animal-to-human extrapolation and uncertainty factors have been applied.

Excess lifetime cancer risks are probabilities that are generally expressed in scientific notation (e.g., $1X10^{-6}$). An excess lifetime cancer risk of $1x10^{-6}$ indicates that, as a plausible upper bound, an individual has a one in one million chance of developing cancer as a result of site-related exposure to a carcinogen over a 70-year lifetime under the specific exposure conditions at a site.

The risk assessment estimates contain certain limitations. There are inherent inaccuracies in risk estimates when making assumptions about population behavior patterns, intake levels, and chemical toxicological data. The risk estimates on the whole tend to be conservative; that is, overstating rather than understating risks in an effort to provide for public safety. Because of the assumptions inherent in the pathway models and other uncertainties, the risk estimates discussed below should be considered no more accurate than plus or minus one order of magnitude.

o Plant Site

The risk assessment considered risks to workers from the plant soils, and to residents from the residential soils. Future risks were calculated in the event that the plant was not operational and was subject to unrestricted residential access. Future risks were also calculated assuming that contaminated groundwater, which is not presently used as a drinking water source, was used and had the same contamination characteristics that it has presently.

For workers, arsenic was the main contaminant of concern. The worst case and most probable risks from arsenic in the site soils were 4×10^{-3} and 2×10^{-7}, respectively. Risks to workers from other chemicals in the soils were insignificant. Risks to workers from groundwater, even if they consumed the plant production well groundwater, were insignificant since the production well's arsenic concentration was far below the Federal Safe Drinking Water Act standard for arsenic, 50 ug/l. This is also known as the Maximum Contaminant Level, or MCL.

For residents, arsenic was the main contaminant of concern. The worst case and most probable risks to residents from exposure to arsenic in the residential soils were 1×10^{-4} and 6×10^{-7}, respectively.

If residents were to develop groundwater supplies from within the contaminated groundwater plume, they would be subject to greatly increased health risks. The worst case risks approached unity, while the most probable risks were 2×10^{-2}. Groundwater from within the plume is not presently used, and the risk assessment indicates that it should not be used until the arsenic concentration in the plume has been substantially reduced.

o River Areas

Two types of risk assessments were performed. In the Blackwater Branch and the upper Maurice River, a semi-quantitative risk assessment of the type discussed above was prepared. In the lower Maurice River, a qualitative risk assessment was performed to estimate in a qualitative sense whether the lower Maurice River posed a potential health threat to exposed populations.

In the Blackwater Branch, the total worst case and most probable carcinogenic risks from arsenic were $5\text{x}10^{-3}$ and $5\text{x}10^{-5}$, respectively. In the upper Maurice River, the total worst case and most probable carcinogenic risks were $1\text{x}10^{-3}$ and $1\text{x}10^{-4}$, respectively. Noncarcinogenic risks were generally minor. In all cases, ingestion, either of sediment, water or fish, constituted most of the risks. Dermal contact with the water and inhalation of dried sediments were insignificant.

In the lower Maurice River, it was estimated that none of the exposure pathways posed increased health risks from arsenic. This was based both on differences in exposure pathways between the upper and lower river, and on the generally lower arsenic concentrations in the lower river.

The ingestion of fish from the upper Maurice River posed risks of approximately $1x10^{-4}$. However, the actual risks may be much lower than the calculated risks. The form of arsenic in fish is generally non-toxic and is easily excreted by humans. Also, the levels of arsenic found in the samples were within the range of arsenic normally found in fish and shellfish.

An increased health risk from ingesting mercury in fish was calculated. However, the risk was based on estimated mercury concentrations in the biota determined from the mercury concentration in the surface water and the bioconcentration factor. The fish samples were not analyzed for mercury, therefore their actual mercury concentration is unknown.

o Union Lake

The risk assessment considered a number of different exposure pathways to the arsenic found in the various environmental media. Risks were calculated for the lake under four different lake full/lake drawdown scenarios. The worst case risk from sediments and water was estimated to be 7×10^{-4} under all four lake full/lake drawdown scenarios. The most probable case risk from sediments and water was estimated to be 1×10^{-5} under all four lake full/lake drawdown studies.

The sediment exposure pathways were considered valid only for shallow water areas, less than approximately two and one-half feet deep. At greater depths, it is unlikely that intimate sediment contact could occur that could cause accidental sediment ingestion.

The fish ingestion pathway was evaluated for arsenic as well as for other organics found in the fish. Of the total fish ingestion risk, approximately 86% resulted from the presence of PCBs thought unrelated to the Vineland Chemical Company site. The arsenic risks from fish were somewhat lower than those found in the river areas.

SCOPE OF THE OPERABLE UNITS

The Vineland Chemical Company site is complex with multiple contamination areas: the plant site, the Maurice River, and Union Lake. This complexity, and the interrelationship of the areas, necessitates that the cleanup be done in discrete phases which are called operable units. The phases or operable units are planned for sequential execution beginning with the plant site. Once the arsenic-contaminated groundwater from the plant site entering the Blackwater Branch is stopped, the cleanup of the Blackwater Branch itself can begin, to be followed by cleanup of the upper Maurice River, as required, and finally Union Lake. The operable units are:

Operable Unit One: Plant Site Source Control

Operable Unit Two: Plant Site Management of Migration

Operable Unit Three: River Areas Sediments

Operable Unit Four: Union Lake Sediments

Operable Unit One addresses the contaminated soils at the plant site. The remedial objectives are to prevent current or future exposure to the contaminated site soils, and to reduce arsenic migration into the groundwater.

Operable Unit Two addresses the contaminated groundwater at the plant site. The objective is to achieve the aquifer cleanup goal of 0.05 mg/l arsenic to the maximum extent practicable.

Operable Unit Three addresses the river areas sediments. The primary objective is to minimize public exposure, either through containment, removal, or institutional controls, for those areas with unacceptably high sediment arsenic concentrations, such as the exposed former sediments in the Blackwater Branch floodplain.

Operable Unit Four addresses the sediments in Union Lake. The primary objective is to reduce potential human health risks by minimizing public exposure to sediments with unacceptably high arsenic concentrations, either through removal, containment, or institutional controls.

The EPA has determined that the elimination of the source of arsenic in to the basin (the contaminated groundwater flowing from the Vineland Chemical Company plant site) would remediate the stream water quality more appropriately than attempting to directly remediate the stream water. The risk assessment and biota studies indicate that there is no reason to perform additional work in the lower Maurice River. Therefore no remedial response objectives were developed for these two portions of the study area.

DESCRIPTION OF ALTERNATIVES

This section describes the remedial alternatives which were developed for each operable unit using all applicable guidance. These alternatives are presented in detail in the FS reports and are summarized below. Table 10 summarizes the site specific soil, groundwater and sediment cleanup goals developed by the EPA and NJDEP for the remedial alternatives.

The RCRA Land Disposal Restrictions (LDRs) impacted all the remedial alternatives for all the sub-areas of the site. The LDRs are one of the many Applicable or Relevant and Appropriate Requirements (ARARs) which apply to remediation at this site, and has a significant effect on all of the remedial alternatives. The performance standards and requirements of the LDR were taken into account in each of the remedial alternatives presented below. The LDRs as they influence remediation at this site are complex. For convenience, Figure 9 presents a schematic diagram illustrating the process. A complete discussion of the LDRs is provided in the FS reports.

EPA Headquarter's Site Policy and Guidance Branch personnel (SPGB) have determined that the arsenic-contaminated soils, sediment and groundwater at the Vineland Chemical Company site are considered the RCRA listed hazardous waste K 031. This is because the arsenic contamination was derived from the listed waste K 031, which was improperly stored or disposed of at the Vineland Chemical Company site.

The EPA is presently developing criteria for the disposal of all listed hazardous wastes, including K 031. In general, these criteria would require treating listed wastes by the Best Demonstrated Available Technology (BDAT). These BDAT standards have been established for some listed wastes, but at this time, no BDAT standard is available for K 031. If a BDAT standard for K 031 waste is not established by May 8, 1990, then land disposal of all K 031 wastes, including the contaminated soils, sediments and groundwater from this site, would be restricted.

After a detailed review of the site-specific contaminant characteristics, EPA established performance criteria which could be used to determine appropriate treatment standards for the contaminated soils, groundwater and sediments in the absence of BDAT levels. These performance criteria will govern the remedial actions at the Vineland Chemical Company site assuming that a BDAT level is established for K 031 wastes by May 8, 1990, so that land disposal is not restricted.

- Soils and Sediments - These materials may be treated in place, or excavated and moved within a contaminated zone, without invoking the LDRs. However, if they are excavated and moved from a contaminated zone, they must be treated so that the treated soil and sediment have an arsenic concentration of less than 0.32 mg/l in the extract from an EP Toxicity Test. The performance criterion of 0.32 mg/l was established by the use of the VHS model as discussed in the FS. If these treated materials meet this level, they are eligible for delisting. Delisting allows these treated materials to be considered nonhazardous and no longer subject to RCRA Subtitle C control.

If the treated soils and sediments cannot meet the target delisting criterion, then EPA will seek to obtain a treatability variance. This variance will allow the treated but non-delistable soils and sediments to be disposed of as hazardous waste in a RCRA Subtitle C landfill. The treatability variance level will be established, as necessary, after a detailed consideration of a number of site-specific factors, including the optimization of the treatment process.

- Groundwater - If the contaminated groundwater is treated in place, land disposal restrictions do not apply. If, however, the groundwater is removed from the ground, then it must be treated to remove arsenic to the MCL of 50 ug/l. If the groundwater is treated to this level, it will no longer "contain" hazardous waste constituents per the "contained in" policy. It could therefore be disposed on land, or could be disposed in a surface water body provided that all other applicable State and Federal requirements for surface water discharge are met.

The two main treatment technologies evaluated for the soils and sediments, extraction and fixation, are expected to produce treated materials that leach arsenic at less than 0.32 mg/l. Therefore the remedial alternatives consider that the treated soils and sediments are eligible for delisting. The EPA has demonstrated through treatability studies that the groundwater can be treated to less than 50 ug/l arsenic. This would permit land or surface water disposal of the treated groundwater.

The authority for delisting rests with different organizations depending on where the treated materials are disposed. If the treated materials are disposed within the confines of this Superfund site, authority for delisting rests with the EPA's Region II Regional Administrator, who announces the intention to delist in the Proposed Plan and the ROD. The Superfund site is the Vineland Chemical Company plant site and all areas of contamination caused by the site, including the Blackwater Branch, Maurice River and Union Lake. Off-site disposal within the State of New Jersey would require a delisting petition to be reviewed by NJDEP. In the event that the treated soils and sediments are disposed of in a state other than New Jersey, delisting would be performed by a delisting petition to the state in question if, like New Jersey, the state has been delegated delisting responsibility by EPA Headquarters, or by filing a petition with EPA Headquarters, if the state has not been granted delisting authority.

After the treated soils and sediments have been delisted and declared nonhazardous, a method of final disposal must be determined. This method is dependent on whether or not the material is classified by the NJDEP as an ID 27 waste. If the material is classified as an ID 27 waste, it must be disposed of in a nonhazardous waste landfill. If the material is not classified as an ID 27 waste, landfill disposal is not required and the material may be used to restore excavated areas of the site or otherwise disposed on-site.

The NJDEP has reviewed the site specific conditions and has determined that, if the soils and sediments are treated such that they leach arsenic at less than 0.32 mg/l in an EP Toxicity Test, and contain arsenic at a concentration less than 20 mg/kg (the most stringent soil/sediment cleanup level used at the site), NJDEP would waive classification of this material as an ID 27 waste.

o OPERABLE UNIT ONE (PLANT SITE SOURCE CONTROL)

The soil cleanup level is 20 mg/kg arsenic, which corresponds to a residential risk of 5×10^{-6}. Figure 10 presents the locations of soils with arsenic above this action level. All of the source control (SC) action alternatives concentrate on these soils. All of the alternatives also include measures to remediate the chicken coops, and to complete substantive portions of RCRA Clean Closure requirements for the two lined impoundments on the plant site. The measures for the coops and impoundments are the same in each of the different source control alternatives discussed below. The source control alternatives differ in the method utilized to remediate the contaminated soils.

The primary source of contamination in the coops is dust; thus, each would first be decontaminated by vacuuming. The vacuumed dust and particulate matter would be treated utilizing the technology for treating the soil within each alternative. If the decontamination procedures do not sufficiently reduce the arsenic contamination, each of the chicken coops would be sealed to prevent public access.

Closure of the lined RCRA impoundments would include removal and off-site treatment and disposal of the wastewater and sludge contained in the impoundments, and excavation, decontamination and off-site disposal of the liners, foundations, piping and any other ancillary equipment associated with the impoundments.

Alternative SC-1: No Action

There are no substantial remediation activities involved in this alternative. Potential public health risks would be reduced by preventing access to contaminated soils by using restrictive fencing and warning signs. Potential environmental impacts via soil leaching would not be reduced.

Plant Site Alternative SC-2: Multilayer Capping System

This alternative includes excavating and consolidating arsenic-contaminated soil in the capping areas, and constructing a multilayer capping system. The cap would consist of a clay layer, a geomembrane, a sand layer and a vegetative layer. Capping would significantly reduce human health threats by minimizing the potential for contaminant contact, and would mitigate adverse environmental impacts by minimizing leachate generation. However, the contaminated soil would remain on-site which would require long-term monitoring. The time to implement this alternative is estimated to be one year.

Plant Site Alternative SC-3A: Excavation/Fixation/Off-Site Nonhazardous Landfill

This alternative involves excavating approximately 126,000 cubic yards of soil. The soil would be fixated with cements and binders which reduce the mobility of arsenic to such a degree that the soils are no longer hazardous. This would enable the fixated product to be delisted. The treated material would be deposited in an existing off-site nonhazardous landfill. This would result in the complete removal of contaminated soil from the site. The excavated areas would be restored using clean fill. The time to implement this alternative is estimated to be one year.

Plant Site Alternative SC-3B: Excavation/Fixation/On-Site Nonhazardous Landfill

This alternative is identical to SC-3A except that the landfill would be a new one built specifically for this purpose on the Vineland Chemical plant site property. The same permanent remediation at the site would be achieved as with Alternative

SC-3A. However, this alternative would require long-term maintenance and monitoring to ensure that the landfill does not leach contaminants.

Plant Site Alternative SC-3C: Excavation/Fixation/On-Site Redeposition

This is the same as Alternative SC-3A except that the treated soils would be redeposited at their approximate original locations. This alternative requires that the NJDEP classify the treated and delisted material as non-ID 27 waste. Long-term monitoring would be required.

Plant Site Alternative SC-4A: Excavation/Extraction/Soils to Off-Site Nonhazardous Landfill/Off-Site Hazardous Sludge Disposal

This involves excavating and treating approximately 126,000 cubic yards of contaminated soils by extraction with water to remove arsenic. The cleaned soils would be delisted and deposited in an existing off-site nonhazardous landfill. The arsenic-contaminated water would be treated to remove the arsenic and discharged to the Blackwater Branch. The sludge by-product of the water treatment would be sent to an existing off-site hazardous waste treatment and disposal facility and would be managed in accordance with the LDR requirements in effect at the time of placement. This alternative would result in the removal of contaminated soils from the plant site; thus, long-term monitoring would not be required. The excavated areas would be restored using clean fill. The time required to implement this alternative is two years.

Plant Site Alternative SC-4B: Excavation/Extraction/Soils to On-Site Nonhazardous Landfill/ Off-Site Hazardous Sludge Disposal

This alternative is the same as SC-4A except that the cleaned soils would be deposited in a new nonhazardous landfill to be built on the Vineland Chemical plant site property specifically for this purpose. This would leave treated soils on-site in the controlled environment of a landfill, which would require long-term maintenance and monitoring.

Plant Site Alternative SC-4C: Excavation/Extraction/On-Site Redeposition of Soils/Off-Site Hazardous Sludge Disposal

This is the same as Alternative SC-4A except that the treated soils would be redeposited at their former locations. This alternative requires that the NJDEP classify the treated and delisted soils as non-ID 27 waste. Since the treated soils would be delisted and no longer classified as waste, the site would be restored to normal use. This alternative would provide essentially the same effective remediation as the other extraction alternatives, with reduced disposal costs. Long-term monitoring would be required.

Plant Site Alternative SC-5: In Situ Flushing

This alternative involves flushing the contaminated soils with water. Some of the soils would first be excavated and consolidated within contiguously contaminated zones. All of the contaminated soils would then be surrounded with a concrete berm and continuously flooded with water. The water which flushes and extracts the arsenic from the soil would percolate to the underlying groundwater where it would be pumped and treated. The groundwater treatment process would result in an arsenic sludge residue which would require off-site hazardous treatment and disposal. Approximately eight years would be required to remediate the soils.

Plant Site Alternative SC-6: In Situ Solidification/Fixation
of Unsaturated Zone Soils

This involves fixation in place, without excavation, using the same fixation process as Alternatives SC-3A, SC-3B, and SC-3C. Similar to Alternative SC-3C, the treated soils would remain at their former locations. Leachate generation and contaminant migration to the groundwater would be eliminated unless the fixation system failed. It is estimated that approximately two years would be required to implement this alternative. Long-term monitoring would be required.

o OPERABLE UNIT TWO (PLANT SITE MANAGEMENT OF MIGRATION)

The groundwater cleanup goal is the MCL for arsenic, 0.05 mg/l, in the shallow aquifer. This goal will be achieved to the maximum extent that is technically practicable.

During design, a combination of pumping and treatment with subsequent natural attenuation of the aquifer to reach the cleanup goal will be evaluated. Pumping and treatment would need to continue at least to an aquifer arsenic level where resumption of groundwater flow to the Blackwater Branch would not cause violation of the arsenic instream standard in that body, 0.05 mg/l.

An application for an Alternate Concentration Limit (ACL) may be sought in accordance with appropriate New Jersey regulations, if, for example pumping and treatment appears to reach a point where it is no more effective than natural attenuation. The need for an ACL and its value would be determined during the early years of remedial action on the aquifer.

The process discussed above, pumping followed by natural flushing, was evaluated in the RI/FS. The alternatives considered, and presented below, specified operation of the pumping and treatment system until the maximum groundwater plume arsenic concentration is 0.35 mg/l. At this concentration, based on the RI/FS information, groundwater flowing to the Blackwater Branch would not cause the instream standard of 0.05 mg/l to be violated. It was estimated that approximately 10 years would be required for natural flushing to reduce the arsenic concentration to 0.05 mg/l after achieving the 0.35 mg/l level.

Plant Site Alternative MOM-1: No Action

This alternative includes a long-term monitoring program and an institutional control program to regulate the use of the aquifer. Natural flushing would reduce the potential health risks over time. However, the groundwater would continue to impact the Maurice River system, and pose human health risks requiring institutional controls on groundwater use.

Plant Site Alternative MOM-2B: Downgradient Capture/Treatment/Reinjection

This alternative involves pumping groundwater from wells located close to the Blackwater Branch for downgradient capture, thereby minimizing the migration of arsenic-contaminated groundwater to the Blackwater Branch. Pumping would be followed by treating the groundwater to the drinking water standards for arsenic, cadmium, and TCE by one of three treatment options to be described later. Treated water would be reinjected to the aquifer. Approximately 75 years would be required to reduce the arsenic plume concentration to 0.35 mg/l, as necessary.

Plant Site Alternative MOM-3A: Downgradient Capture and Source Area Pumping/Treatment/Discharge to the Maurice River

This entails a combination of the downgradient pumping scheme of MOM-2B with additional pumping from extraction wells in the higher concentration source area to shorten the cleanup time. The treated water would be discharged through a pipeline to the Maurice River. Approximately 30 years would be required to reduce the arsenic plume concentration to 0.35 mg/l.

Plant Site Alternative MOM-3B: Downgradient Capture and Source Area Pumping/Treatment/Reinjection

This alternative is the same as MOM-3A except that the treated water would be reinjected to the aquifer instead of being discharged to the Maurice River, thus accelerating the remediation time. Approximately 25 years would be required to reduce the arsenic plume concentration to 0.35 mg/l.

Plant Site Alternative MOM-4A: Site Pumping/Treatment/Reinjection/Discharge to the Maurice River

This alternative involves using additional extraction wells in the high concentration source area to achieve a higher pumping rate than with the other MOM alternatives, which significantly hastens the cleanup. Treated groundwater would be reinjected to the aquifer to the maximum extent practicable, with the remainder discharged to the Maurice River. Approximately 13 years would be required to reduce the arsenic plume concentration to 0.05 mg/l, based on the FS.

Groundwater Treatment Process Options

The following are treatment options for removing arsenic, cadmium and TCE:

Treatment Process Option T1: Chemical Precipitation/Air Stripping/Vapor Phase Activated Carbon Adsorption/Liquid Phase Activated Alumina Adsorption

Treatment Process Option T2: Chemical Oxidation/Chemical Precipitation/Ion Exchange/Liquid Phase Activated Carbon Adsorption

Treatment Process Option T3: UV-H_2O_2 Oxidation/Chemical Precipitation

All three process options would clean the contaminated groundwater to the MCL for arsenic, cadmium, and TCE. Common to all three is a chemical precipitation step, which uses iron salts to remove the arsenic and cadmium from the water. The three options differ in the method used to remove the TCE; process T1 employs air stripping, while T2 uses carbon adsorption, and T3 uses oxidation to destroy the TCE. The three options also differ in the method used as a final step to "polish" the treated water and remove any residual arsenic or cadmium down to the MCL.

- **OPERABLE UNIT THREE (RIVER AREA SEDIMENTS)**

The sediment cleanup level is 120 mg/kg arsenic in the submerged sediment, and 20 mg/kg arsenic in the exposed sediment in the Blackwater Branch floodplain. These correspond to risks of 1×10^{-5}. Figure 11 shows the areas to be remediated in the Blackwater Branch floodplain.

River Areas Alternative 1: No Action

Potential public health risks from river sediments would be reduced by limiting access through sign posting and educational programs. Existing environmental contamination would continue, but could be decreased at a significant rate through natural processes after the flow of arsenic from the plant site is stopped. Monitoring would be required to document the nature and scope of the natural processes.

River Areas Alternative 2A: Dredging/Excavation/Thickening/Fixation/Off-Site Nonhazardous Landfill

This entails excavating approximately 56,200 cubic yards of exposed contaminated sediment in the Blackwater Branch floodplain, dredging approximately 21,000 cubic yards of submerged contaminated sediment in the Blackwater Branch and the Upper Maurice River, and treating them via fixation. Fixation would utilize cements and binders to reduce the mobility of arsenic. After delisting, the treated product would be disposed of in an off-site nonhazardous landfill. Clean fill would be placed in the excavated areas of the floodplain to restore it to its original condition, but no fill would be brought into the submerged river areas. Long-term post-implementation management would be required to monitor possible sediment redistribution. Possible short-term environmental impacts include disturbing floodplain and/or wetland areas during construction, and impacts from truck traffic.

River Areas Alternative 2B: Dredging/Excavation/Thickening/Fixation/On-Site Nonhazardous Landfill

Alternative 2B is the same as Alternative 2A, except that the treated and delisted sediments would be disposed of in a nonhazardous landfill built specifically for this purpose at the Vineland Chemical Company plant site. This alternative would require long-term maintenance and monitoring to ensure that the landfill does not leach contaminants, and to monitor possible sediment redistribution.

River Areas Alternative 3A: Dredging/Excavation/Extraction/Sediments to Off-Site Nonhazardous Landfill/Off-Site Hazardous Sludge Disposal

Alternative 3A entails the same excavation and dredging activities as Alternatives 2A and 2B. Instead of being fixated, the arsenic would be extracted from the sediment with water. The extractant would be treated to remove arsenic prior to its discharge into the rivers. The sludge containing the extracted arsenic would be disposed of off-site by a licensed hazardous waste disposal vendor and will be managed in accordance with the LDR requirements in effect at the time of placement. The excavated floodplain would be restored with clean fill, but no fill would be used to restore the submerged river areas.

Long-term monitoring for sediment redistribution in the rivers would be required.

River Areas Alternative 3B: Dredging/Excavation/Extraction/ Sediments to On-Site Nonhazardous Landfill/Off-Site Hazardous Sludge Disposal

Alternative 3B is the same as Alternative 3A except that the extracted sediments would be disposed of in an on-site nonhazardous landfill. The landfill would be built specifically for this purpose at the Vineland Chemical Company plant site. Administrative approvals and land acquisition would be required. Long-term maintenance and monitoring would be required to ensure the landfill's integrity and to determine possible sediment redistribution.

River Areas Alternative 3C: Dredging/Excavation/Extraction/ Floodplain Deposition of Exposed Sediments/Plant Site Deposition of River Sediments/Off-Site Hazardous Sludge Disposal

Alternative 3C is the same as Alternatives 3A and 3B except the treated floodplain sediments would be deposited back into the Blackwater Branch floodplain at their former locations. The treated submerged sediments from the Blackwater Branch and the Maurice River would be deposited on undeveloped areas of the Vineland Chemical Company plant site. This alternative requires that the NJDEP classify the treated and delisted sediments as non-ID 27 wastes. This alternative would provide the same effective remediation as the other extraction alternatives, with reduced disposal costs. Monitoring of the floodplain, plant site, and river sediments would be required.

o OPERABLE UNIT FOUR (UNION LAKE SEDIMENTS)

Figure 12 shows the contaminated areas in Union Lake which will be remediated, as discussed below.

In the high access public areas, which include the public beach and the Tennis and Sailing Club, "hot spots" with arsenic concentrations above 20 mg/kg will be remediated from the shoreline to a distance from the shore at which the lake water depth is 5 feet. Approximately 24,100 cubic yards of contaminated sediment are located in this area.

In the high access residential areas along the eastern shoreline, "hot spots" above 20 mg/kg arsenic will be remediated to a minimum lake depth of 2.5 feet, continuing to either a maximum distance of 150 feet from the shoreline, or a lake depth of 5 feet. This comprises approximately 9,900 cubic yards of contaminated sediment.

In the low access areas, e.g., the lake's western shore, "hot spots" above 120 mg/kg will be remediated to a minimum lake water depth of 2.5 feet, continuing to either a maximum distance of 150 feet from the shoreline or a lake depth of 5 feet. This comprises approximately 96,650 cubic yards of contaminated sediment.

Removal of the sediments as described above will reduce the cancer risk level via the sediment ingestion exposure pathways to 2×10^{-6} in the more accessible areas. The cancer risk level in the less accessible areas will be reduced to less than 1×10^{-5}.

Union Lake Alternative 1: No Action

Potential public health risks from lake sediments would be reduced by sign posting and educational programs. Existing environmental contamination would continue, but could be decreased in the lake through natural processes after the flow of arsenic from the plant site is stopped, or by sediment resuspension and transport. Long-term monitoring would be required.

Union Lake Alternative 2A: Removal/Fixation/Off-Site Non-Hazardous Landfill

This entails removing contaminated sediments identified above, treating them by fixation with cements and binders to reduce arsenic mobility, and disposing of the delisted treated sediments at an existing nonhazardous landfill. Excavated areas would be restored using clean fill, as in all the alternatives except 3C and 5. Contamination in sediments in the deeper areas of the lake would remain, but could be decreased through natural processes after the flow of arsenic from the plant site is stopped. Long-term post-implementation monitoring of the lake sediments would be required since not all of the contaminated sediments in the lake would be remediated.

Union Lake Alternative 2B: Removal/Fixation/On-Site Non-Hazardous Landfill

This is the same as Alternative 2A except that the fixated and delisted sediments would be disposed of at a new nonhazardous landfill built specifically for this purpose at the Vineland Chemical Company plant site. Additional long-term maintenance and monitoring would be required to ensure the landfill's integrity.

Union Lake Alternative 3A: Removal/Extraction/Sediments to Off-Site Nonhazardous Landfill/Off-Site Hazardous Sludge Disposal

This alternative uses the same sediment removal activities as Alternatives 2A and 2B. However, in place of fixation, extraction with water would be used to remove arsenic from the contaminated sediments. The cleaned sediments would be sent to an existing nonhazardous landfill. Arsenic in the extraction water would be converted to a sludge during treatment, and would be disposed of at an existing off-site hazardous waste facility. The treated water would be returned to the lake. Long-term monitoring of sediment redistribution would be required.

Union Lake Alternative 3B: Removal/Extraction/Sediments to On-Site Nonhazardous Landfill/Off-Site Hazardous Sludge Disposal

This alternative is the same as 3A except that the extracted sediments would be disposed of at a new nonhazardous landfill built on the Vineland Chemical Company property specifically for this purpose. Additional long-term monitoring and maintenance would be required for the landfill.

Union Lake Alternative 3C: Removal/Extraction/Lake Redeposition of Sediments/Off-Site Hazardous Sludge Disposal

This alternative is the same as 3A except that the extracted sediments would be redeposited as fill for remediated areas in the lake. This alternative requires that the treated and delisted sediments be classified as non-ID 27 wastes by the NJDEP. Long-term monitoring would be required.

Union Lake Alternative 3D: Removal/Extraction/Plant Site Deposition of Sediments/Off-Site Hazardous Sludge Disposal

This alternative is the same as 3A except that the cleaned and delisted sediments would be deposited at the Vineland Chemical Company plant site in appropriate undeveloped areas. The same waste classification steps required in Alternative 3C apply to this alternative. Long-term monitoring at the plant site and in the lake would be required.

Union Lake Alternative 5: In Situ Sand Cover

This provides a type of containment by capping areas of contaminated sediments with a one foot layer of clean sand. This would reduce human health and environmental impacts. However, the contaminated sediments would remain in the lake. Also, it is possible that the clean sands used as cover could become contaminated through contact with the sediments, further complicating the remedial effort, and in fact adding to the quantity of material to be treated.

EVALUATION OF ALTERNATIVES

Pursuant to CERCLA, EPA must evaluate each alternative with respect to nine criteria. These criteria were developed to address the requirements of Section 121 of SARA. The nine criteria are: short-term effectiveness; long-term effectiveness; reduction of toxicity, mobility and volume; implementability; cost; compliance with ARARs; overall protection of human health and the environment; state acceptance; and community acceptance. The discussion which follows provides a summary of the analysis, relative to these criteria, of all of the alternatives under consideration for the operable units at the Vineland Chemical Company site. A complete analysis is provided in the FS reports and is summarized in Tables 11 through 15.

OPERABLE UNIT ONE (PLANT SITE SOURCE CONTROL)

- Short-Term Effectiveness: This criterion evaluates the time required for an alternative to achieve performance, and the potential adverse impacts from its implementation.

  Alternative SC-1 could be implemented in weeks. The remaining alternatives, except for Alternative SC-5, which would require eight years, could be implemented within two years.

  All of the alternatives, except SC-1, present potential short-term risks to workers, the community and environment from fugitive dust emissions during the remedial action. However, adequate dust suppression measures and a traffic control plan would be developed to minimize these potential exposures. Workers would be properly protected through utilization of personnel protective equipment. Site access would be restricted during implementation of all source control alternatives.

- Long-Term Effectiveness: This category addresses the long-term effectiveness and reliability of an alternative.

  The no action alternative would require that natural processes reduce the soil contamination. It would take many years to achieve the cleanup goal of arsenic in the soils.

  Tests have shown that the fixation process would make the arsenic less leachable from the soils in the long-term; however there is always a potential for failure. Alternatives 3A and 3B would be more effective than 3C since disposal would be in a landfill and leachate could be controlled. In

Alternative 3A, the landfill would be off-site, which would be more protective for the Vineland Chemical Company site than the on-site landfill called for in 3B, but would offer the same overall protection of the environment in general.

Extraction would be an effective process in the long-term since the arsenic is actually removed from the treated soils to the point where it is not leachable by water. Therefore there is a minimal need to encapsulate the cleaned soils. Alternative 4C provides a means of disposal that is as effective as the landfill alternatives, since the arsenic remaining on the soils should not be leachable by water.

In situ fixation, SC-5, has the same drawbacks as SC-3C since the fixated soils would be disposed in a non-controlled environment. In situ flushing has the same advantages as the other extraction alternatives with the added advantage that minimal soil excavation would be required, and that an extraction treatment system would not be required.

The capping alternative, SC-2, has the long-term concern that the cap could eventually fail, requiring a reapplication or maintenance. This alternative would require long-term monitoring, as would all of the alternatives except 3A and 4A which remove all of the contaminants from the site.

o Reduction of Toxicity, Mobility and Volume: This category evaluates the alternatives in terms of reducing the toxicity, mobility and volume of hazardous substances at a site.

Of all the source control alternatives considered, those involving extraction offer the highest reduction of toxicity, mobility and volume. The no action or capping alternatives would yield no reduction of toxicity or volume, and there are no long-term guarantees regarding the reduction of mobility offered by a multilayer cap. In situ soil flushing would reduce the volume and toxicity of contaminants over a period of time, but increased mobility of contaminants would be required to achieve this. This alternative would require a groundwater capture system to contain the flushed arsenic. Fixation would reduce the mobility of the contaminants only, as they would remain stabilized in their present soil matrix. Fixation would also increase the volume of soil as large quantities of additives would be required.

o Implementability: This category addresses how easy or difficult, feasible or infeasible, it would be to carry out a given alternative. This covers implementation from design through construction, operation and maintenance. The implementability of an alternative is evaluated in terms of technical and administrative feasibility, and the availability of required goods and services.

The feasibility of both the extraction and fixation processes were proven in treatability studies. Both use equipment that is readily available from a number of vendors. In situ fixation would require more specialized equipment than fixating excavated soils, and may be less available on the market.

In situ flushing is the simplest treatment alternative to implement. It is believed that this alternative will work based on information gathered in the RI/FS. However, the effectiveness of this technology would have to be verified through bench/pilot scale studies during design.

Capping is easy to implement and uses equipment and materials which could be provided by a number of different vendors.

The extraction alternatives require more administrative efforts than the fixation alternatives. Although a discharge permit is not required, the treated water would be in compliance with all New Jersey discharge regulations. Additional administrative efforts will be required to dispose of the sludge in a hazardous waste landfill.

On-site landfilling requires intensive efforts for land acquisition and requires long-term monitoring. Off-site landfilling requires less effort for land acquisition, but requires efforts to secure available landfill space. Both require administrative efforts to delist the treated soils.

Redeposition of extracted soils requires no land acquisition, but does require delisting and a non-waste classification by the NJDEP. Redeposition of fixated soils requires land acquisition, monitoring, delisting, and a non-waste classification. Fixating the soils in situ negates the need for delisting and the non-waste classification.

Capping requires land acquisition and land use restrictions, and requires long-term monitoring. This does not require delisting.

In situ flushing would require the least administrative effort. Delisting would not be required, a non-waste classification would not be required, and no land use restrictions or long-term monitoring would be required since the contaminants would be removed.

- Cost: The present worth cost for each alternative is as follows:

  Alternative SC-1: $ 1,122,000
  Alternative SC-2: $ 7,232,000
  Alternative SC-3A: $62,937,000
  Alternative SC-3B: $35,466,000
  Alternative SC-3C: $26,484,000
  Alternative SC-4A: $44,560,000
  Alternative SC-4B: $25,102,000
  Alternative SC-4C: $16,934,000
  Alternative SC-5: $ 5,159,000
  Alternative SC-6: $24,872,000

- Compliance with ARARs: Section 121 (d) of CERCLA, requires that remedial actions comply with all applicable or relevant and appropriate Federal and State requirements for hazardous substances, pollutants, or contaminants that are attributable to a site.

  All of the remedial alternatives for this operable unit, except no action, can be designed to meet all Federal and State ARARs. A discussion of all of the ARARs for the selected remedy for this operable unit is presented in the Statutory Determinations section of this ROD. Below is a brief discussion of the ARARs which would differ between alternatives.

  The no action alternative, the in situ treatment alternatives, and the capping alternative would not invoke the provisions of the LDR. This is because no excavation of the contaminated soils outside of the area of contiguous contamination is required. The remaining alternatives would invoke the LDR.

  The extraction alternatives would require that the discharge of the treated extractant meet New Jersey requirements, and would require that the sludges be disposed of in accordance with applicable RCRA regulations. The fixation alternatives would not involve these ARARs, since water treatment and sludge generation are not required with fixation.

- Overall Protection of Human Health and the Environment: This category evaluates the alternatives in terms of their ability to achieve overall protection of human health and the environment, which is the central mandate of CERCLA.

  The fixation alternatives render the contaminants in the soil insoluble and immobile, thus greatly minimizing leachate generation. The extraction alternatives remove the arsenic from the soil, affording the greatest protection to human health and the environment. The capping system reduces public health risks by minimizing direct contact with the contaminated soil, and prevents adverse impacts to the environment by minimizing leaching and subsequent migration of the contaminants. However, if the capping system fails, the threat to human health and the environment would be present. In situ flushing would adequately protect human health; however, adverse impacts to the environment could occur due to the failure of the pumping or treatment system, or from the extended remediation period required by this alternative. No action provides minimal protection to human health and the environment.

- State Acceptance: Comments from the State generally focused upon disposal of material generated by the treatment systems considered in the alternatives. The State also questioned whether the remediation would include the two RCRA impoundments on site. Closure of the two RCRA impoundments has been added to all of the alternatives except no action. The State concurs with the selected remedy discussed later in this document.

- Community Acceptance: One individual questioned why in situ vitrification had not been considered as a remedial technology. It had, but was screened out in the technology screening portion of the FS. The remaining comments were generally supportive of any efforts being made to clean up the plant site, and did not distinguish between the remedial alternatives presented to achieve this. Additional specific public comments on this and other operable units are presented in the Responsiveness Summary section of the ROD.

OPERABLE UNIT TWO (PLANT SITE MANAGEMENT OF MIGRATION)

- Short-Term Effectiveness: The alternatives requiring pumping and treatment basically differ from one another in the time required to achieve remediation. Based on the RI/FS data, Alternative 4A requires the least time, 13 years, but the highest pumping rate, up to 2,700 gallons per minute (gpm) initially. Alternative 2B requires the longest time, 75 years, with the lowest pumping rate, approximately 750 gpm. It is estimated that the no action alternative would require well over one hundred years to achieve remediation.

  All of the pumping and treatment alternatives involve at a minimum downgradient capture, or stopping the flow of contaminated groundwater into the Blackwater Branch. The extraction wells would be sited such that the downgradient capture zone was as close to the Blackwater Branch as possible without inducing infiltration from the bank. A small zone of arsenic contamination will therefore exist between the capture zone and the Branch. The arsenic in this zone will have to flush prior to the full effect of downgradient capture being realized. During design, the closeness of the downgradient capture zone to the Blackwater Branch will be optimized to achieve the most expedient remediation without inducing excessive infiltration.

- Long-Term Effectiveness: Implementing the no action alternative would require restricting the future use of the groundwater for well over one hundred years, and allowing the arsenic contaminated groundwater to migrate into the surface water and adversely impact the downstream water quality over the long-term.

  Implementing any of the remaining pumping and treatment alternatives would be effective at achieving cleanup in the long-term. The remediation would be permanent (assuming a successful source control alternative) since the arsenic contaminated groundwater would be removed from the aquifer and treated.

  If in situ flushing is implemented for the source control alternative, a portion of the treated groundwater would be utilized as flush water. It is estimated that approximately 400 gpm of flush water would be required and that the in situ flushing alternative would operate simultaneously with the pumping alternative for eight years. Implementation of the flushing alternative would result in an additional load of arsenic to the aquifer. It is estimated that in situ flushing would increase the remediation time period by approximately 10 percent.

- Reduction of Toxicity, Mobility or Volume: The no action alternative would not immediately reduce the toxicity, mobility or volume of groundwater contaminants. A reduction would be achieved over time, though, as the groundwater transports the contaminants downgradient and off-site, continually dispersing them throughout the entire study area.

  The remaining alternatives would offer essentially the same reductions of toxicity, mobility and volume by removing contamination from the groundwater and eliminating its off-site migration. Reinjection would increase the mobility of the contaminants in the groundwater to speed the cleanup, but they would not be allowed to migrate off-site.

- Implementability: All of the pumping and treatment alternatives employ basically the same technologies that are standard and readily available from a number of vendors (e.g., well installation, pipeline construction). Alternative MOM-4A would operate at a very high pumping rate, 2700 gpm initially, and would require an increase in the size and number of treatment units over the other alternatives. This could create slight difficulties for installation and operation not anticipated with the other alternatives.

The no action alternative involves considerable administrative effort to ensure long-term restriction of groundwater use, to perform long-term monitoring, and to review the groundwater conditions existing within the contaminated aquifer through time.

The remaining alternatives would remediate the aquifer to an arsenic concentration of 0.35 mg/l (target level based on RI/FS data which may change during the final design) via pumping and treatment, and then, if additional data from design and operation show that pumping and treatment is no more effective than natural attenuation, allow natural flushing to reduce the arsenic concentration to 0.05 mg/l. Administrative efforts would be required to establish a well restriction area to prohibit the installation of new potable water supply wells and to require the sealing of any existing potable water supply wells until the concentration of 0.05 mg/l was reached.

Administrative efforts would also be required for the pumping alternatives to obtain permission to access properties to install monitoring wells or pipelines off of the Vineland Chemical Company property.

- Cost: The present worth value for each alternative considering utilization of Treatment Option T2 is as follows:

  Alternative MOM-1: $ 289,000
  Alternative MOM-2B: $44,981,000
  Alternative MOM-3A: $44,181,000
  Alternative MOM-3B: $39,936,000
  Alternative MOM-4A: $34,148,000

  Table 13 presents the cost of each alternative considering the various treatment options.

- Compliance with ARARs: Alternative MOM-1 would not satisfy the contaminant-specific groundwater ARARs. If long-term monitoring is executed and a well restriction area is established, Alternative MOM-1 would meet location and action-specific ARARs.

  New Jersey surface water discharge standards would apply to the alternatives requiring a surface water discharge, while they would not apply to the alternatives requiring total on-site reinjection.

The remaining alternatives would all have to meet the same action, contaminant, and location specific ARARs, which are discussed in the Statutory Determinations section.

- Overall Protection of Human Health and the Environment: The no action alternative would not afford any protection to the environment in that the source of arsenic into the basin would not be stopped. The environmental damage caused by this discharge would not be mitigated. However, human health would be protected by not allowing contaminated groundwater to be utilized.

  The remaining alternatives offer essentially the same overall protection. Contaminated groundwater flow would be stopped as reliably and quickly by any of the pumping and treatment alternatives. They differ only in the length of time pumping would be required to achieve remediation, but not in the goal of remediation.

- State Acceptance: The State's comments regarding the pumping alternatives focused on its desire to maximize reinjection and minimize the amount of discharge into the Maurice River or the Blackwater Branch. Reinjection has been incorporated into some of the alternatives to the maximum extent practicable. Discharge of the treated groundwater to the Maurice River, if necessary, is not expected to pose any significant adverse environmental impacts.

  The State was also involved in investigating a two-step approach to the aquifer cleanup goal, i.e., (1) pump and treat to a maximum level of arsenic in the aquifer that could be allowed to discharge into the Blackwater Branch without violating the instream standard of 0.05 mg/l arsenic and, (2) if additional data show that pumping and treatment is not more effective than natural attenuation, allow the aquifer to flush naturally to an arsenic concentration of 0.05 mg/l. The 0.35 mg/l arsenic level used in the RI/FS is the calculated maximum concentration at which the load of arsenic in the groundwater would not violate the instream arsenic standard in the Blackwater Branch at the 7-day 10-year low flow. This was calculated considering the estimated flow of groundwater from the Vineland Chemical Company plant. During design the estimate of groundwater flow from the plant will be refined, thereby allowing recalculation of the groundwater pumping and treatment maximum arsenic concentration objective.

  The State concurs with the selected remedy discussed later in this document.

- Community Acceptance: No specific public comments were received that distinguished between any of the presented alternatives. The public was generally supportive of any efforts being made to eliminate the flow of arsenic into the Maurice River drainage system from the Vineland Chemical Company plant.

OPERABLE UNIT THREE (RIVER AREAS SEDIMENTS)

- Short-Term Effectiveness: The no action alternative could be implemented in weeks and would result in minimal short-term effects to the local community. However, it could possibly restrict the use of the river areas.

  The remaining alternatives could be implemented in three years and could pose potential public health threats to the neighboring communities and on-site workers via inhalation of fugitive dust. Standard construction dust-suppression techniques would minimize these potential threats. On-site workers would be provided with personnel protective equipment.

  Excavation of the Blackwater Branch floodplain in Alternatives 2A, 2B, 3A, 3B or 3C could disturb wetland areas, causing potential short-term environmental impacts. Prior to the excavation of any exposed sediment, a floodplain/wetlands assessment of the impacts of excavation will be performed.

  Dredging activities conducted in Alternatives 2A, 2B, 3A, 3B or 3C could disturb riverine and wetland areas, causing possible short-term environmental impacts. Prior to the dredging of any sediment, an environmental assessment of the impacts of dredging will be performed.

- Long-Term Effectiveness: The no action alternative would result in some residual risk remaining on-site. The exposed floodplain sediments would probably not be remediated naturally over time, since there is no water flowing over them. However, the river is a dynamic system. Natural transport mechanisms may significantly reduce the arsenic contamination within the submerged sediments.

  Dredging could cause possible long-term impacts to the Maurice River system. An environmental assessment will be performed prior to removing any submerged sediment.

  The fixation alternatives (2A and 2B) have the potential for failure as the arsenic is not removed from the treated sediments. However, disposal would be in a landfill environment where any leachate could be controlled.

  The extraction alternatives actually remove the arsenic from the sediments to unleachable levels and thus provide greater reliability than fixation. Additionally, the need for disposal of the treated sediment in a landfill is minimized. Deposition of the treated floodplain sediments in their original locations and site deposition of the treated river sediments, outlined in Alternative 3C, would be protective.

Off-site landfilling of the treated materials would not require a long-term management program. However, those alternatives involving on-site landfilling or floodplain deposition would require long-term monitoring to assess the effectiveness of the alternatives.

In any of the action alternatives, monitoring would be required for a period of time to ensure that the sediments do not redistribute.

- Reduction of Toxicity, Mobility or Volume: No action does not reduce the toxicity, mobility or volume of the contaminants. The extraction alternatives (3A, 3B, and 3C) offer the highest reduction of toxicity, mobility and volume. Fixation would reduce only the mobility of the arsenic, and would actually increase the volume of sediment to be disposed.

- Implementability: No action consists of simple tasks which present no implementation difficulties. Implementing the remaining alternatives involves the use of standard equipment that is commercially available and technologies that are developed and proven.

  Bench-scale tests have proven that fixation (Alternatives 2A and 2B) and extraction (Alternatives 3A, 3B, and 3C) are feasible for treating the arsenic-contaminated sediments. However, pilot-scale tests are required to provide design criteria. Pilot-scale tests would be performed if any of these alternatives are selected.

  Alternative 3C specifies disposal of the treated material in uncontrolled environments. If Alternative 3C failed, which is very unlikely, the Blackwater Branch would have to be reexcavated and the deposition areas of the plant site removed.

  No action requires surveillance in order to attain effective access restriction. Implementation of the remaining alternatives would require long-term operation and maintenance activities which would include periodic site sampling, and monitoring on-site landfills (Alternatives 2B and 3B) and deposition areas (Alternative 3C).

  Site deposition, the simplest means of final disposal, would require administrative efforts. NJDEP would have to classify the treated material as non-ID 27 waste.

- Cost: The present worth cost for each alternative is as follows:

Alternative 1:	$ 874,000
Alternative 2A:	$60,809,000
Alternative 2B:	$43,666,000
Alternative 3A:	$24,710,000
Alternative 3B:	$16,875,000
Alternative 3C:	$14,186,000

- Compliance with ARARs: All of the remedial alternatives, except no action, can be designed to meet all Federal and State ARARs. A discussion of all ARARs for the selected remedies is presented in the Statutory Determinations section of this ROD. Below is a brief discussion of the ARARs which would differ between alternatives.

  Alternative 3C would require the NJDEP to waive an ID 27 classification subsequent to delisting. The other alternatives would require only delisting.

  The extraction alternatives would require that the discharge of the treated extractant meet New Jersey regulations, and would require that the sludges be disposed of in accordance with applicable RCRA regulations. These ARARs do not apply to the fixation alternatives as no water treatment or sludge generation is associated with them.

  The New Jersey Solid Waste Regulation (NJAC 7:26), particularly Subchapter 2A, Additional Specific Disposal Regulation for Sanitary Landfills (May 5, 1986), would be considered in managing treated nonhazardous wastes for both on-site and off-site landfills under Alternatives 2A, 2B and 3A or 3B.

- Overall Protection of Human Health and the Environment: The no action alternative would not contribute to the protection of human health and the environment.

  The remaining alternatives all remove and treat the contaminated sediments identified as a public health threat. Using these alternatives to remove the contaminated source, assuming no significant redistribution of the remaining contaminated sediments, and control of the contaminated groundwater entering the river from the Vineland Chemical Company site, would facilitate protection of human health and the environment. However, if contaminated submerged sediments left in the rivers did redistribute, this would require additional remediation.

- State Acceptance: The State desired an alternative that did not require either on-site or off-site nonhazardous disposal. Alternative 3C addresses this comment.

The State also expressed the need for an environmental assessment of the impacts of dredging to be performed prior to remediation of submerged sediments. The State concurs with the selected remedy discussed later in this document.

- Community Acceptance: The community expressed some opposition to dredging activities for the submerged sediments. Concerns were focused on (a) some residents not believing the health threat from the sediments existed because there was no imminent sign of adverse effects, (b) concern over environmental damage to the river itself due to dredging, and (c) concern over environmental damage from constructing support facilities such as roads in the wetlands.

  The EPA assured the community that remediation of submerged sediments would take place only if necessary following a three-year "natural flushing" period, as discussed in the Selected Remedy section of this ROD. EPA also assured the residents that appropriate studies would be performed prior to dredging to determine the environmental impacts of dredging and ways to minimize those impacts if dredging were necessary.

OPERABLE UNIT FOUR (UNION LAKE SEDIMENTS)

- Short-Term Effectiveness: The implementation of the no action alternative would require weeks and would result in minimal short-term effects to the local community. However, it may restrict the use of the lake.

  The implementation of the remaining alternatives would present minor threats to the community and on-site workers. Potential impacts include fugitive dust emissions during sediment removal and placement of the sand cover. This could be easily minimized.

  Alternatives 2A, 2B, 3A, 3B, 3C and 3D involve removing contaminated sediments. Dredging would be conducted if the lake were at full condition. This may cause more adverse environmental impacts than excavation which could be done with lake at drawdown. Excavation would allow greater control in sediment removal. The sand cover could be more accurately and easily applied with the lake at drawdown.

  The time required to complete Alternatives 2A and 2B, 3A, 3B, 3C and 3D is estimated to be three years. One year is required for Alternative 5.

- Long-Term Effectiveness: The no action alternative would require some years for natural attenuation and transport mechanisms to reduce significantly the volume of arsenic in the sediment.

With the remaining alternatives, contaminated sediments with concentrations above the target level would remain in the lake, although in areas not deemed a public health risk. Long-term monitoring would be required. If significant redistribution of the sediments occurs, additional remedial actions may be required.

Fixation would immobilize the arsenic in the sediments; however, the possibility of failure would always exist.

Extraction offers a more effective process since the arsenic is actually removed from the sediment to the point where it is not leachable. Therefore, there is minimal need for landfilling the treated sediment.

- Reduction of Toxicity, Mobility or Volume: No action does not reduce the toxicity, mobility or volume of the contaminants. The remaining alternatives reduce the volume of contaminants in the lake. Fixation alternatives reduce the mobility of the arsenic in the fixed product; the contaminant becomes immobilized within a tightly bound matrix. The extraction alternatives reduce the toxicity of the sediments. The sand covering alternative does not reduce the toxicity or volume of contaminated sediment. However, it is expected to reduce the mobility.

- Implementability: All of the alternatives use standard equipment that is commercially available from a number of vendors.

  Both dredging and excavation are well developed and proven means of sediment removal. Excavation would provide a greater means of control to ensure that all contaminated sediments would be removed.

  Alternative 5 requires standard construction equipment and fill material. This could be most easily implemented with the lake at drawdown; however, placing a layer of sand over contaminated sediment in shallow water is relatively easy.

  Long-term operation and maintenance activities would be required for all of the alternatives and would include periodic site sampling, performing five-year reviews, and monitoring on-site landfills (Alternatives 2B and 3B) or deposition areas (Alternative 3C and 3D).

  All of the alternatives would require administrative attention, particularly Alternatives 2B, 3B, 3C and 3D which involve constructing an on-site nonhazardous landfill facility, or the lake deposition or plant site deposition of treated materials. No action may require considerable administrative effort to restrict lake access, if necessary, pending the results of resampling activities and sediment redistribution studies.

- o Cost: The present worth value for each alternative is as follows:

	Lake at Full Condition	Lake at Drawdown
Alternative 1:	$ 874,000	$ 874,000
Alternative 2A:	$ 71,247,000	$ 68,840,000
Alternative 2B:	$ 51,414,000	$ 49,006,000
Alternative 3A:	$ 29,227,000	$ 27,417,000
Alternative 3B:	$ 20,133,000	$ 18,323,000
Alternative 3C:	$ 14,752,000	$ 12,942,000
Alternative 3D:	$ 18,233,000	$ 16,422,000
Alternative 5:	$ 3,369,000	$ 2,400,000

- o Compliance with ARARs: All of the remedial alternatives for this operable unit, except no action, can be designed to meet all Federal and State ARARs as discussed in the Statutory Determinations section of this ROD. Below is a brief discussion of the ARARs which would differ between alternatives.

Hydraulic dredging activities in the lacustrine areas would require compliance with Federal Rivers and Harbors Act Section 10. The Clean Water Act Section 404 requires that no activity affecting a wetland shall be permitted if a practicable alternative with less impact on the wetland is available. Dry excavation when the lake is at drawdown would have less impact and would therefore be favored relative to this ARAR.

The no action alternative and the sand covering alternative would not invoke the provision of the LDR. The remaining alternatives are subject to LDRs. Subsequent to delisting, NJDEP would have to waive an ID 27 waste classification of the treated sediments in Alternatives 3C and 3D.

The extraction alternatives would require that the discharge of the treated extractant meet New Jersey regulations, and would require that the sludges be disposed of in accordance with applicable RCRA regulations. These ARARs do not apply to the fixation alternatives as no water treatment or sludge generation is associated with them.

The New Jersey Solid Waste Regulation (NJAC 7:26), particularly Subchapter 2A - Additional Specific Disposal Regulation for Sanitary Landfills (May 5, 1986) would be considered in managing treated nonhazardous wastes for both on-site and off-site landfills under Alternatives 2A, 2B and 3A or 3B.

- Overall Protection of Human Health and the Environment: The no action alternative would require natural attenuation to reduce sediment arsenic contamination.

  All of the remaining alternatives would remediate only those sediments deemed a public health risk near the shoreline. A significant percentage of the contaminated sediments would not be remediated. Since these could always redistribute, this is only an interim measure. Additional remedial actions may be required.

- State Acceptance: The State requested that consideration be given to conducting the remedial action when the lake is at its full condition and when the lake is at drawdown. In addition, the State recommended sampling prior to the initiation of the remedial alternative to confirm the location of those sediments to be treated.

  The State also requested that an environmental assessment be performed prior to remediating sediments in the less accessible northern end of the lake. The State concurs with the selected remedy discussed later in this document.

- Community Acceptance: The community response was generally divided on the lake alternatives. Some residents felt that EPA should take whatever actions were necessary to clean the lake so that it is safe for recreation since the lake is such a popular recreational area. Others felt that the lake as it exists poses no health threat, and therefore remediation was unnecessary and may be detrimental to some popular fishing spots.

  The overriding sentiment was that the lake should be reopened. The community was very pleased to hear that the NJDEP would reopen the lake for boating and fishing (two activities that do not promote sediment contact) after dam repairs are finished and the lake is refilled in late 1989.

SELECTED REMEDY/STATUTORY DETERMINATION

Section 121(b) of CERCLA requires EPA to select remedial actions which utilize permanent solutions and alternative treatment technologies to the maximum extent practicable. In addition, EPA prefers remedial actions that permanently and significantly reduce the mobility, toxicity or volume of site wastes.

After a careful review and evaluation of the alternatives presented in the feasibility study and consideration of all evaluation criteria, EPA presented the following alternatives to the public as the preferred remedies for the four operable units at the Vineland Chemical Company site:

- o Operable Unit One (Plant Site Source Control)
  - Alternative SC-5: In Situ Flushing
- o Operable Unit Two (Plant Site Management of Migration)
  - Alternative MOM-4A: Site Pumping/Treatment/Reinjection/ Discharge to the Maurice River
- o Operable Unit Three (River Areas Sediments)
  - Alternative 3C: Dredging/Excavation/ Extraction/ Floodplain Deposition of Exposed Sediments/Plant Site Deposition of River Sediments/Off-site Hazardous Sludge Disposal
- o Operable Unit Four (Union Lake Sediments)
  - Alternative 3: Removal/Extraction/Lake Deposition of Sediments/Off-Site Hazardous Sludge Disposal

The input received during the public comment period, consisting primarily of questions and statements submitted at the public meeting held on July 18, 1989, is presented in the attached Responsiveness Summary. The public comments encompass a wide range of issues, but do not necessitate any major changes in the remedial approach taken at the site.

SELECTED REMEDIES

Based on consideration of the requirements of CERCLA, the NCP, the Administrative Record, the evaluations of alternatives discussed in the previous section, and public comments, EPA, with NJDEP concurrence, has selected remedies for each operable unit as described below.

o Operable Unit One: Plant Site Source Control

In Situ Flushing is selected as the remedy because it is a permanent remedy and it offers the most cost effective treatment with minimal impacts to the environment. The costs associated with this remedy are presented in Table 16.

This remedy involves excavating approximately 54,000 cubic yards of contaminated soils within the contiguous zones of contamination, and consolidating these soils with approximately 72,000 cubic yards of undisturbed contaminated soils into the active flushing zones. These zones will be bermed and continuously flooded with flushing water. The water will dissolve and carry the arsenic from the soil to the underlying groundwater. Groundwater pumping and treatment, which must be performed together with this source control remedy, will convert the arsenic to a sludge. The sludge will be transported to an off-site RCRA treatment and disposal facility.

Decontaminating the chicken coops will also be conducted as part of the remedial action. The dust and particulate matter recovered from the coops will be consolidated in the active flushing zones. If it is determined that the decontamination procedure did not effectively reduce the human health risks, the chicken coops will be sealed to prevent public access, and/or dismantled and transported to a RCRA Subtitle C facility for disposal.

Closure of the two RCRA lined impoundments will comply with the substantive portions of the RCRA clean closure requirements. The wastewater and sludge recovered from the impoundments will be transported to an off-site RCRA treatment and disposal facility, as necessary. The recovered impoundment construction materials will be steam cleaned and transported to an off-site RCRA Subtitle C facility for disposal. Since the two impoundments are within the lagoon area, any contamination in the soils near them will be flushed to the water table through the implementation of this remedy. The arsenic will treated by the pumping and treatment system.

- Operable Unit Two: Plant Site Management of Migration

Alternative MOM 4A, Site Pumping/Treatment/Reinjection/Discharge to the Maurice River, is the selected remedy. This remedy satisfies the objective of minimizing the flow of arsenic-contaminated groundwater to the Blackwater Branch, while providing a cost effective and timely remediation. In the RI/FS, approximately 13 years of pumping and treatment was required to achieve a maximum groundwater arsenic plume concentration below 0.35 mg/l. At this concentration, the instream standard of 0.05 mg/l arsenic in the Blackwater Branch was not violated. An additional 10 years was required for the aquifer to naturally flush to meet the remediation goal of 0.05 mg/l. Table 17 presents the costs associated with this remedy as investigated in the RI/FS.

The site pumping system evaluated in the FS consisted of approximately 31 extraction wells. The actual number of wells will be determined in design. The wells will be located to minimize contaminant migration to the Blackwater Branch and to remove high concentration portions of the plume.

The total pumping rate in the FS was approximately 2700 gpm initially (31 wells each pumping at approximately 90 gpm). Extraction wells that were in portions of the plume where the arsenic concentration dropped below the action level, 0.35 mg/l, were shut off during remediation as necessary. This substantially reduced the annual operation and maintenance costs.

Additional data will be collected during design and operation of the pumping system. If these data show that a point is reached beyond which pumping and treatment is not more effective than natural attenuation, the arsenic will be allowed to flush naturally to the cleanup goal, 0.05 mg/l. The pumping and treatment maximum arsenic objective calculated in the FS, 0.35 mg/l, will be recalculated during design. If a new target level is necessary, it will be set such that the instream standard for arsenic, 0.05 mg/l, is not violated in the Blackwater Branch.

The selected groundwater treatment method is Treatment Process Option T2, which consists of chemical oxidation of organic contaminants using potassium permanganate, physical and chemical precipitation of metals, filtration, ion exchange polishing of treated effluent, and activated carbon adsorption of TCE. This treatment system will reduce arsenic concentrations in the treated groundwater to below MCLs. The sludge generated from this treatment system will be transported to an off-site RCRA treatment and disposal facility. All treatment residuals (e.g. spent carbon, ion exchange regenerant) will be disposed of according to applicable RCRA regulations.

After treatment to MCLs, the treated water will be recharged to the aquifer at the maximum rate practicable, and will be used to provide the flushing water required for the in situ flushing of contaminated soil. Any remaining water will be discharged to the Maurice River, as necessary.

A well restriction area will be established during remediation, until the cleanup goal of 0.05 mg/l arsenic is met.

o Operable Unit Three: River Areas Sediment

The selected remedy is Alternative 3C. Remedial action on the exposed Blackwater Branch floodplain sediments will begin soon after arsenic flow in the groundwater to the Blackwater Branch is stopped. It will entail excavating sediments with an arsenic concentration above 20 mg/kg (approximately 56,200 cubic yards), extraction with water to remove arsenic from the sediments, and redeposition of treated sediments in the floodplain. Prior to excavation of the exposed sediments, a floodplains/wetlands assessment will be performed. At about the same time, approximately 6,400 cubic yards of contaminated submerged sediments in the Blackwater Branch adjacent to and downstream of the Vineland Chemical plant site will be dredged. Prior to removing any sediments, an environmental assessment of the impact of dredging will be performed and a confirmation that these sediments are a source of contamination for the river system will be made. The dredged material will be extracted with water to remove arsenic, and then deposited in appropriate undeveloped areas of the Vineland Chemical Company plant site. After extracting arsenic from the sediments, the arsenic-laden water will be treated to remove the arsenic and the sludge residue will be transported to an existing off-site hazardous waste facility for treatment and disposal. All other treatment residuals will be disposed according to applicable RCRA regulations.

Contamination in the submerged sediments of the Maurice River is expected to be significantly reduced over time, by the natural scouring and dissolution effects of the river, especially after arsenic flow from the plant site has been stopped. Therefore, remediation of these submerged sediments will occur, as necessary, beginning no sooner than three years after the arsenic flow from the plant site has stopped. Remediation will entail dredging, extraction with water to remove arsenic from the sediments, and deposition of the cleaned sediments in undeveloped areas of the plant site. Similar to the Blackwater Branch, dredging the Maurice River will be subject to an environmental assessment of its effect on the ecology.

The costs associated with the selected remedy are itemized in Table 18.

o Operable Unit Four: Union Lake Sediments

The selected remedy is 3C. This involves lowering Union Lake's water level, and removing sediments from those portions of the lake's periphery which contain arsenic at concentrations that present an unacceptable exposure risk to the public. For the sediments in the upper end of the lake, above the submerged dam, removal will be done by dredging and excavation. However, prior to dredging any sediments, an environmental assessment of the impact of removal will be performed. For the remainder of the lake, below the submerged dam, sediments will be excavated after lowering the water level. Table 19 presents the costs associated with this remedy.

The removed sediments will be washed with water to extract arsenic, and, after treatment, will be returned as fill for the remediated areas. The extraction water will be treated to convert the arsenic to a sludge for off-site hazardous treatment and disposal. All treatment residuals will be disposed according to applicable RCRA regulations. The treated water will be returned to the lake.

This is an interim remedy which is protective of the public health while further study is done. The interim remedy will not begin until after the submerged river sediments have been remediated (if necessary, and after an assessment of the river's natural cleansing performance).

ADDITIONAL ACTIVITIES

Some additional activities will be performed during the initial phases of the remedial design process and prior to implementation of the selected remedial alternatives. These activities are described below:

- Column leaching tests will be performed to confirm the effectiveness of in situ flushing and to establish desorption characteristics of the soil. These tests will help to determine at what point arsenic will cease desorbing from the contaminated soil, and may provide a superior value for the coefficient Kd. This will allow design of an optimized pumping and treatment system.

- Additional soil data will be obtained to define fully areas for plant site soil remediation in Operable Unit One. Also, the full extent of arsenic contamination underneath the buildings and paved manufacturing areas of the Vineland Chemical Company plant site will be determined.

- A pumping test will be performed to obtain design-level aquifer hydraulic properties in order to optimize the pumping and treatment remedial action chosen for the contaminated groundwater.

    - If the pumping test yields hydraulic properties that are different from those used in the RI/FS, revision of the pumping and treatment target level from 0.35 mg/l arsenic in the groundwater may be required to protect the instream standard of 0.05 mg/l arsenic in the Blackwater Branch.

    - If the chosen groundwater remediation scheme requires that treated water be discharged into the Maurice River or the Blackwater Branch, studies will be performed to assure that the streams can handle the additional flow.

- Additional monitoring wells will be installed to define the total extent of the groundwater arsenic plume. Specifically, the extent of the groundwater plume to the northwest, west, and south will be investigated.

- Subsequent to stopping the flow of arsenic to the Blackwater Branch through the implementation of a groundwater management of migration alternative, a three year flushing period for the Maurice River will begin. Monitoring of surface water and sediments during this period will determine the effectiveness of natural flushing mechanisms in the river and the need for additional remedial action in the river areas.

- The mass balance of arsenic coming in and out of the basin will be determined to aid in the assessment of the river's natural flushing mechanisms. Gauging stations will be installed on the Blackwater Branch downstream of the Vineland Chemical Company plant site and at the inlet of Union Lake, and a flow measuring device will be installed on the dam at the controlled outlet of Union Lake. Water samples from these stations will be obtained periodically, as will samples from the existing United States Geologic Survey (USGS) streamflow gaging station on the Maurice River at Norma. The data from these four stations will determine the arsenic load at four points in the basin. From this, the mass balance of arsenic in the basin and in Union Lake will be determined. This will also establish a data base prior to performing any remedial action in the river, and will help to determine the effectiveness of the actions.

- Mathematical modeling will be developed to forecast distribution patterns of the sediments within the Maurice River and Union Lake. Data from the above sampling program will be used to calibrate and optimize the model. This information will help to determine the need for remediation in the river and lake, and the long-term effectiveness of any such remediation.

- An environmental assessment of the Blackwater Branch, the Maurice River and the northern portion of Union Lake will be performed in the early stages of design, if remediation is necessary as determined by natural flushing studies and modeling studies discussed previously. The objective of the environmental assessment is to evaluate the nature and extent of potential environmental damage which may result from dredging operations (including support activities). The results of this environmental assessment will be used to determine the extent of dredging.

- Additional sediment samples will be collected to verify arsenic contamination within Union Lake. These sediments will also be analyzed for PCBs, as trace amounts of PCBs were detected in fish. PCBs have a high bioconcentration factor; therefore, small amounts in the water or sediment can produce detectable concentrations in fish. The PCBs detected in the fish are not believed to be related to the Vineland Chemical Company.

- Further studies will be performed on the biota in the area to determine the effects of arsenic on the biota at the sediment cleanup levels chosen for the remedial action. Also, the mercury concentration of the edible biota will be determined because of concerns raised by the concentration of mercury in the water and the bioconcentration factor of mercury.

- Before any remedial action is taken, a Stage IA survey will be performed to insure that important prehistoric and historic cultural resources are identified.

- A field survey to comply with the Endangered Species Act will be conducted prior to any remedial actions.

- Executive Orders 11990 and 11988, regarding protection of wetlands and floodplains, respectively, will be complied with by conducting wetlands and floodplain assessments during the design phase of the plant site and Blackwater Branch portions of the project.

- Remedial actions in the rivers and Union Lake will be evaluated in terms of impacting the lower Maurice River below Union Lake, in accordance with the Coastal Zone Management (CZM) Act and the New Jersey CZM Plan.

- The chosen treatment process for each operable unit will be optimized through bench and pilot scale tests to assure that the treated material will meet the delisting requirements with a considerable degree of certainty. In addition, verification testing conducted throughout the remedial action will assure that the substantive standards of the delisting program are met and that only nonhazardous wastes are removed from Subtitle C control.

STATUTORY DETERMINATIONS

PROTECTIVENESS

The selected remedy for Operable Unit One protects human health by preventing contact with the soils and by ultimately reducing the soil contamination to a lifetime risk level of 5×10^{-6} for residents, which is within the range specified by EPA. A groundwater pumping and treatment system must be implemented together with this remedy to collect and treat the leached arsenic.

The selected groundwater pumping and treatment remedy for Operable Unit Two is protective of the environment and human health. The system will minimize the flow of contaminated groundwater to the Maurice River system. As a result, natural flushing dynamics could mitigate the arsenic contamination downstream. A well restriction area will be established during remediation to minimize potential health threats.

The selected remedy for Operable Unit Three is protective of human health. The remediation strategy specifies a three year period to assess the river's natural cleansing performance. This three year period will begin when the flow of arsenic-contaminated groundwater from the site is effectively eliminated.

The exposed and submerged Blackwater Branch floodplain will be remediated during this three year period. If the Maurice river contamination is sufficiently reduced during this period, human health risks will have been reduced and remediation will not be required. If the contamination has not flushed sufficiently, then remediation will be undertaken to reduce human health risks. Prior to removing any sediments, an environmental assessment will be performed. Human health will be protected during this period through the implementation of institutional controls. At the completion of this cleanup, the risks will be below 1 x 10^{-5}.

The interim remedy for Operable Unit Four is protective of human health as the remediation strategy is based on public accessibility. Sediments above the cleanup goals in accessible areas will be removed, thus eliminating the principal exposure pathway of ingestion. However, as arsenic-contaminated sediments above the cleanup goals will remain in the lake, long-term monitoring is required to assess sediment transport patterns.

COMPLIANCE WITH APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARs):

The remedial objectives for Operable Units One, Three and Four were developed based on the public health risk assessment considering Federal and State ARARs. The risk based cleanup level for plant site soils corresponds to the NJDEP "To Be Considered" (TBC) criterion for arsenic cleanup in soils. It is not required to cleanup to a TBC, therefore the cleanup standard was established through health-based concerns. The cleanup goal for Operable Unit Two is the MCL for arsenic established by the Safe Drinking Water Act. This may need to be achieved by first pumping to an ACL, if additional data show that pumping and treatment is not more effective than natural attenuation, then allowing the aquifer to naturally flush to reduce the arsenic concentration to the MCL.

All excavation of soil above the cleanup goal will be executed in accordance with Occupational Safety and Health Administration (OSHA), New Jersey Soil Erosion and Sediment Control Act, and pertinent New Jersey floodplain area construction requirements.

The two RCRA surface impoundments are located within the flushing zones. This CERCLA action will meet the substantive portions of RCRA Clean Closure Requirements for these lagoons.

All dredging activities would be conducted so as to minimize resuspension and erosion in order to comply with the requirements of the Federal Rivers and Harbors Act Section 10. Additionally, dredging and excavation will avoid wetland areas where possible, and wetland restoration will be implemented for the disturbed areas in order to comply with Sections 401 and 404 of the Clean Water Act. After the completion of remediation, any wetlands that have been disturbed would be restored to their original conditions.

The U.S. Fish and Wildlife Coordination Act requires that the appropriate agency exercising jurisdiction over wildlife resources, and the U.S. Fish and Wildlife Service, must be consulted before undertaking any action that modifies a body of water. Special attention must be given to the impact on wetlands and floodplains (river and lake shores) in accordance with Executive Orders 11990 and 11988. This is applicable to both Operable Units Three and Four.

All of the selected remedies will comply with RCRA facility standards and OSHA industry standards and regulation concerning hazardous waste.

Supernatant from the dredging process and extractant from the extraction process will be treated in accordance with Federal and State ARARs prior to discharge. A New Jersey Pollutant Discharge Elimination System (NJPDES) permit would not be required for on-site discharge, but the permit conditions regarding arsenic concentration would be met. The treated effluent would also meet the New Jersey Surface Water Quality Standards in terms of arsenic and other conventional parameters (such as suspended solids and pH). The treated effluent would comply with the EPA guidelines for disposal of dredged or fill material (40 CFR 230) by restoring and maintaining the chemical, physical and biological integrity of river water in accordance with the Clean Water Act (CWA Section 404). Reinjection of the treated water will comply with the NJDEP's standard for reinjecting treated water.

Sludge contaminated with arsenic will be generated in the treatment systems associated with each operable unit. These sludges would be transported in accordance with the Department of Transportation (DOT) regulations regarding transport of a hazardous waste and disposed of in accordance with applicable RCRA regulations.

At the start of remedial design for any of the operable units a Stage IA Survey, consisting of a comprehensive literature search, will be conducted in accordance with the National Historic Preservation Act.

Remedial activities upstream of Union Lake may flush arsenic downstream to the lower Maurice River and Delaware Bay affecting coastal resources below the Union Lake dam. The Coastal Zone Management (CZM) Act will be considered during design to minimize this affect. Accordingly, remedial activities will be evaluated for consistency with the New Jersey CZM Plan.

The discussion above dealt with pertinent ARARs to be considered for all of the operable units. Extremely critical ARARs relative to the implementation of the selected remedies at the Vineland Chemical Company site are the RCRA Land Disposal Restrictions (LDRs), which restrict the disposal of hazardous wastes. As discussed previously, the contaminated soil, sediments and groundwater within the study area are considered RCRA listed wastes, and therefore LDRs are applicable. The following determination incorporates pertinent factors in the LDRs.

In Operable Unit One, the contaminated soil will be excavated and consolidated within flushing zones having contiguous contamination prior to treatment. Thus, Operable Unit One is not subject to LDRs.

The groundwater in Operable Unit Two will be treated to the MCL for arsenic, and will no longer "contain" arsenic as stated in the "contained in" rule. This treated groundwater may therefore be disposed on land, in the in situ flushing leach fields, or may be reinjected. Groundwater treated to this level may also be disposed in surface water bodies, provided that the substantive portions of NJPDES requirements are met. Since the groundwater will be treated to the MCL for cadmium and TCE, in addition to arsenic, this condition will be met.

The sediments in Operable Units Three and Four will be removed prior to treatment, so that LDRs are applicable. In Operable Unit Three, the delisted sediments will be disposed of on undeveloped areas of the Vineland Chemical Company plant site, or in the case of the floodplain sediments, within the areas of excavation. The treated sediments from Operable Unit Four, Union Lake, will be redeposited as fill for the excavated areas. All of these disposal locations constitute on-site disposal, and therefore the delisting authority will rest with EPA's Region II Regional Administrator.

The treated sediment would be delisted if the material meets the performance standards of the VHS model (0.32 mg/l leachable arsenic) and the most stringent risk-based arsenic level established in the risk assessments for the sub-areas (20 mg/kg). Delisting of the sediments would classified them as nonhazardous. The NJDEP informed EPA that if the delisted material meets the 20 mg/kg arsenic concentration established in the risk assessment, it would then be eligible for deposition on the plant site, or within the excavation areas of the Blackwater Branch floodplain and Union Lake.

Both the sediment extraction process and the groundwater treatment system will produce a highly contaminated sludge, which will be treated. This sludge may be disposed of in a Subtitle C hazardous landfill in accordance with the LDR requirements in effect at the time of placement. However, it may be possible to treat the sludges to render them nonhazardous. If this can be accomplished, and if the delisting performance criteria discussed above are met for the treated sludges, EPA would comply with the administrative requirements to delist the treated sludges. This would allow the treated and delisted sludges to be disposed of in a nonhazardous landfill.

COST EFFECTIVENESS

The selected remedies afford high overall effectiveness proportional to their costs.

In Situ Flushing is the least expensive means of achieving the remedial objectives for Operable Unit One because it does not require any substantial process implementation, other than integration with the groundwater remediation system.

The selected groundwater remedy for Operable Unit Two is the least expensive alternative because it takes the least time to complete.

The selected remedy for Operable Unit Three utilizes water extraction which is much less expensive than fixation. Further, the preferred remedy specifies floodplain deposition and plant site deposition, which are considerably less costly than the landfilling options.

The selected interim remedy for Operable Unit Four is an economical solution compared to the other alternatives entailing removal and treatment. Although Alternative 5, In Situ Sand Cover, is the least expensive alternative, it is less effective, does not include treatment, and leaves arsenic in the remediated areas.

UTILIZATION OF PERMANENT SOLUTIONS AND ALTERNATIVE TREATMENT TECHNOLOGIES TO THE MAXIMUM EXTENT PRACTICABLE

The selected remedial actions utilize permanent solutions and treatment technologies to the maximum extent practicable, and provide the best balance among the evaluation criteria of all the alternatives available.

In Situ Flushing, the selected remedy for Operable Unit One, best satisfies the evaluation criteria. It utilizes treatment and is permanently effective once the arsenic passes from the soil into the groundwater. Toxicity, mobility and volume of contaminants would be reduced once cleanup goals are met. Fewer short-term impacts are expected than with competing alternatives because less excavation is required. Implementation is not complex, but further testing is required. Cost is significantly lower than other alternatives.

In addition, the capping alternative does not treat the contaminated soil, nor is it permanent. The competing batch treatment alternatives (fixation and extraction) require the construction and operation of a treatment facility thus greatly increasing the cost. Additionally, the fixation alternatives do not reduce the toxicity or volume of contaminants. The competing batch treatment alternatives are less implementable than the selected remedy due to the uncertainties of available off-site nonhazardous landfill sites or the opposition (both public and state) to construction of on-site landfills.

The use of groundwater pumping at a high flow rate (site pumping), with treatment to remove the contaminants, followed by reinjection and discharge, meets the evaluation criteria successfully and provides for a permanent solution. Long-term effectiveness and permanence would be achieved once the groundwater cleanup goal is reached. Toxicity, mobility and volume of the groundwater contaminants would be reduced, and the flow of arsenic to the Maurice River system would be stopped. Short-term effectiveness is achieved because the short-term risks to on-site workers during and after installation are minimal. A short period of time will be required to halt groundwater flow to the Blackwater Branch after installation of the system. Implementability is high in that reliable commercially available operations are employed for pumping and treatment. The cost for this alternative is significantly lower than that of the other alternatives because the higher pumping rate results in the shortest time to finish the cleanup. The competing alternatives require significantly longer periods of remediation (as long as 75 years) resulting in increased costs.

For the exposed Blackwater Branch floodplain area, excavation of the contaminated zones, subject to a floodplains/wetlands assessment of the impacts of excavation, followed by water extraction to remove arsenic, and redeposition of the cleaned sediment as fill material in its former locations best meets the evaluation criteria. By removing the contaminants from the sediments to a safe level and disposing of contaminants at an off-site hazardous waste facility, this alternative would permanently protect human health and the environment, comply with ARARs, and reduce the toxicity, mobility and volume of contaminants. Implementability would be simple because only commercially available equipment would be required. The cleaned and delisted sediments would no longer be regarded as a waste. This alternative is the least costly of the competing alternatives.

Similarly, dredging the submerged sediments contaminated above cleanup goals in the Blackwater Branch and the upper Maurice River, followed by water extraction to remove arsenic, and depositing the cleaned sediments in undeveloped areas of the Vineland Chemical Company plant site meets the criteria. The submerged Blackwater Branch sediments would be dredged, subject to an assessment of the effects of dredging on the river ecology, at about the same time that the exposed floodplain sediments are remediated. Any submerged sediments contaminated above cleanup goals remaining in the Maurice River above Union Lake would be dredged after the three year natural flushing period, as necessary, pending the results of an environmental assessment. The dredged material would be extracted with water to remove arsenic, and the cleaned sediments deposited in appropriate undeveloped areas of the plant site. In addition, because disposal of the cleaned sediment as clean fill for the remediated river areas is not easily implementable, disposal would occur at the Vineland Chemical Company plant site where cost would be somewhat higher. Nonetheless, the overall cost is the lowest of the implementable alternatives.

The chosen alternative for Operable Unit Three utilizes treatment and will achieve a permanent solution. Since all of the alternatives remove the same contaminated sediments at the same action level, all would afford the same degree of health protection. Competing fixation alternatives have higher treatment and disposal costs with no increase in effectiveness. Competing extraction alternatives have higher disposal costs with no increase in protectiveness. Since extraction removes arsenic from the sediments to the point where arsenic is no longer leachable by water, floodplain or on-site disposal would pose no threat from future leaching.

The selected remedy for Union Lake sediments, Operable Unit Four, is an interim remedy to protect the public while further study is performed. The interim remedy would begin after the submerged river sediments have been remediated (if this is deemed necessary after assessing the river's natural cleansing performance), to avoid recontaminating areas of the lake. An interim remedy is appropriate in this situation providing it does not result in any of the following: directly cause additional migration of contaminants; complicate the site cleanup, present an immediate threat to public health or the environment; or interfere with, preclude, or delay the final remedy, consistent with EPA's priorities for taking further action. All of the alternatives could be designed to meet the foregoing limitation except Alternative 5 (In Situ Sand Covering), which could complicate or delay any final remedy. Therefore, the remedy choice criteria were used to select the best interim remedy from the remaining alternatives.

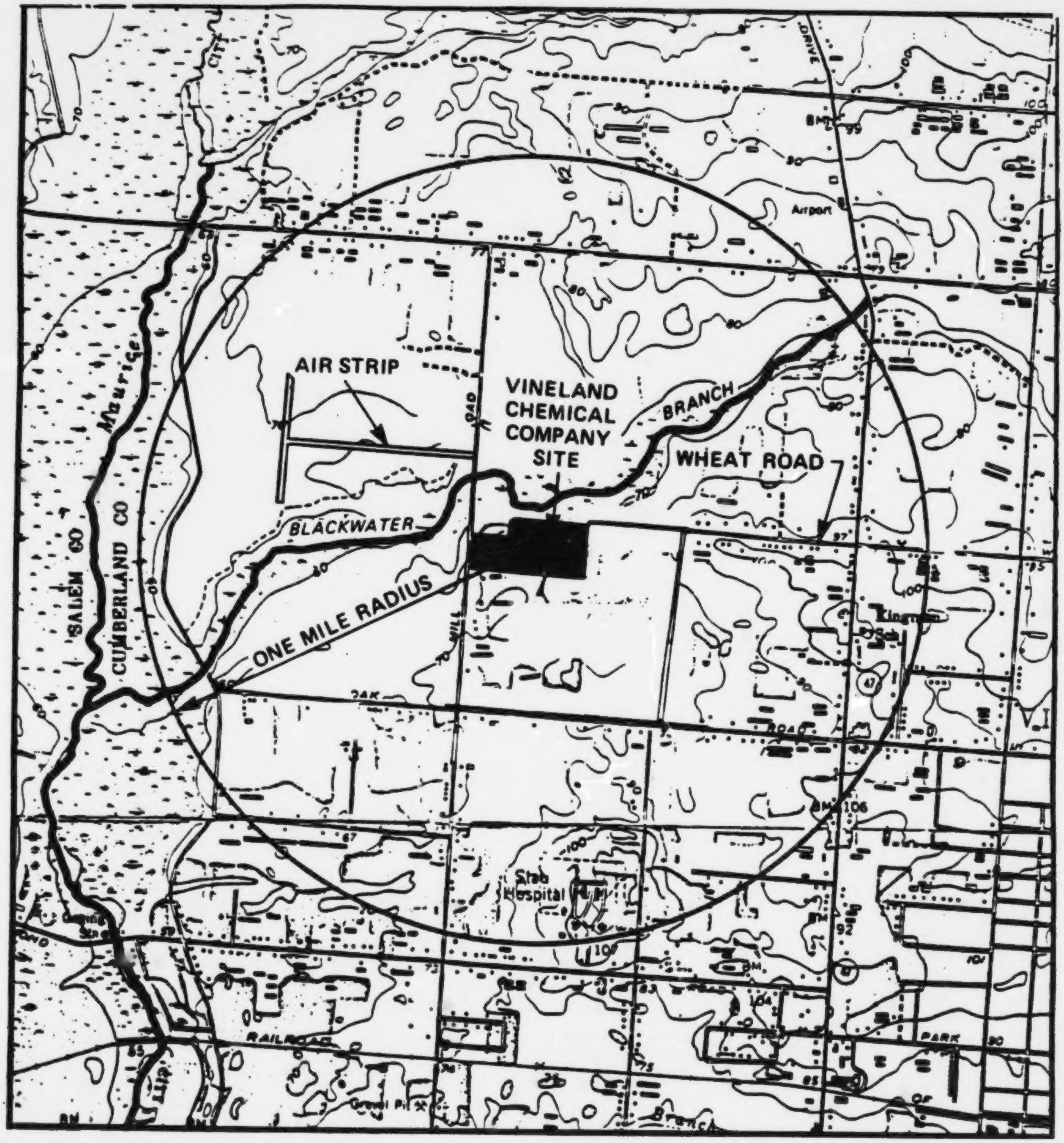
Removal of sediments in Union Lake's periphery containing arsenic at levels above cleanup goals, followed by extraction with water to remove arsenic, and returning of the cleaned sediments to their former locations in the lake, would meet remedy choice criteria. By reducing the sediment arsenic concentration to an acceptable level, human health would be protected. Arsenic toxicity, mobility and volume in the lake would be reduced. Since redistribution of the remaining arsenic contaminated sediments is possible, long-term monitoring would be performed. Short-term effectiveness is high with minimal and controllable adverse impacts during removal and redeposition. This alternative is simple to implement since it uses available commercial equipment and reliable technology. Cost for this alternative is the lowest among those which use treatment. The competing fixation alternatives are less attractive as no decrease in toxicity of arsenic is realized. The competing extraction alternatives require acquisition of off-site landfill space or construction of an on-site landfill, thus decreasing their implementability.

In summary, the selected remedy for each of the four operable units provides the best balance among the alternatives with respect to the criteria used to evaluate remedies. Based on the information available, EPA and NJDEP believe the selected remedies are protective of human health and the environment, attain ARARs, use permanent solutions and treatment technologies to the maximum extent practicable and are cost-effective.

DOCUMENTATION OF SIGNIFICANT CHANGES

The Proposed Plan for this site was released for public comment in July 1989. The Proposed Plan identified the preferred alternatives discussed in the ROD.

EPA reviewed all written and verbal comments submitted during the public comment period. Upon review of these comments, it was determined that no significant changes to the remedies, as they were originally identified in the Proposed Plan, were necessary.


AIR STRIP
VINELAND CHEMICAL COMPANY SITE
BRANCH
WHEAT ROAD
BLACKWATER
ONE MILE RADIUS
SALEM CO
CUMBERLAND CO
Maurice
OAK
ROAD
Airport
Kingman Sch
State Hospital
RAILROAD
PARK
Gravel Pit
Branch

SCALE 1:24000

0 — 1 MILE

BASE MAP PREPARED BY U.S.G.S., 1977

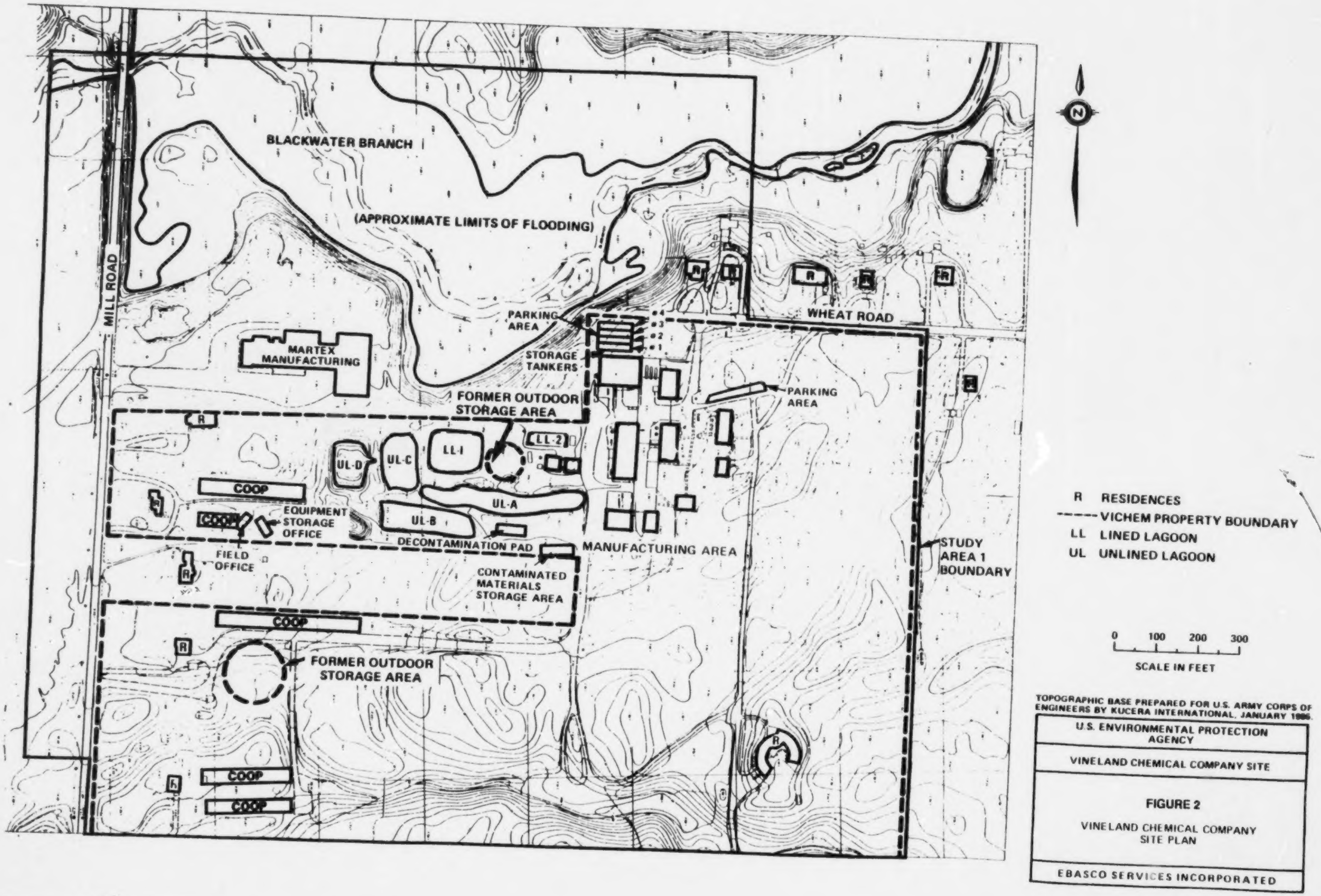
U.S. ENVIRONMENTAL PROTECTION AGENCY

VINELAND CHEMICAL COMPANY SITE

FIGURE 1

VINELAND CHEMICAL COMPANY
ONE MILE RADIUS

EBASCO SERVICES INCORPORATED


BLACKWATER BRANCH
(APPROXIMATE LIMITS OF FLOODING)
MILL ROAD
WHEAT ROAD
MARTEX MANUFACTURING
PARKING AREA
STORAGE TANKERS
FORMER OUTDOOR STORAGE AREA
PARKING AREA
LL-1
LL-2
UL-A
UL-B
UL-C
UL-D
COOP
COOP
COOP
COOP
COOP
EQUIPMENT STORAGE OFFICE
FIELD OFFICE
DECONTAMINATION PAD
MANUFACTURING AREA
CONTAMINATED MATERIALS STORAGE AREA
FORMER OUTDOOR STORAGE AREA
STUDY AREA 1 BOUNDARY
R
N
R RESIDENCES
VICHEM PROPERTY BOUNDARY
LL LINED LAGOON
UL UNLINED LAGOON
0
100
200
300
SCALE IN FEET

TOPOGRAPHIC BASE PREPARED FOR U.S. ARMY CORPS OF ENGINEERS BY KUCERA INTERNATIONAL, JANUARY 1986.

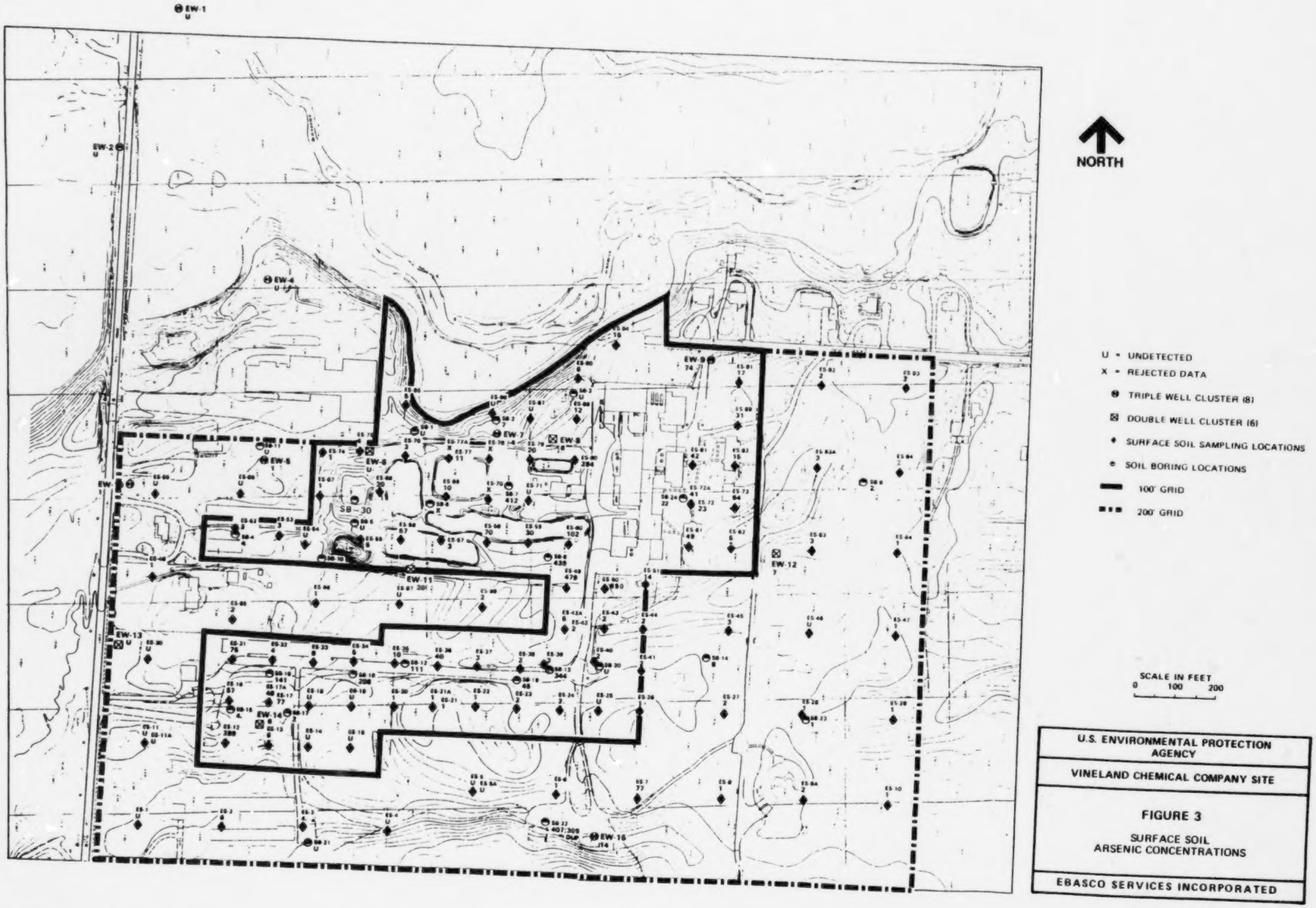
U.S. ENVIRONMENTAL PROTECTION AGENCY

VINELAND CHEMICAL COMPANY SITE

FIGURE 2

VINELAND CHEMICAL COMPANY SITE PLAN

EBASCO SERVICES INCORPORATED


NORTH
U = UNDETECTED
X = REJECTED DATA
TRIPLE WELL CLUSTER (8)
DOUBLE WELL CLUSTER (6)
SURFACE SOIL SAMPLING LOCATIONS
SOIL BORING LOCATIONS
100' GRID
200' GRID
SCALE IN FEET
0 100 200
EW-1
U
EW-2
U
EW-4
EW-5
EW-6
EW-7
EW-8
EW-9
74
EW-11
201
EW-12
7
EW-13
U
EW-14
EW-15
114
SB-30

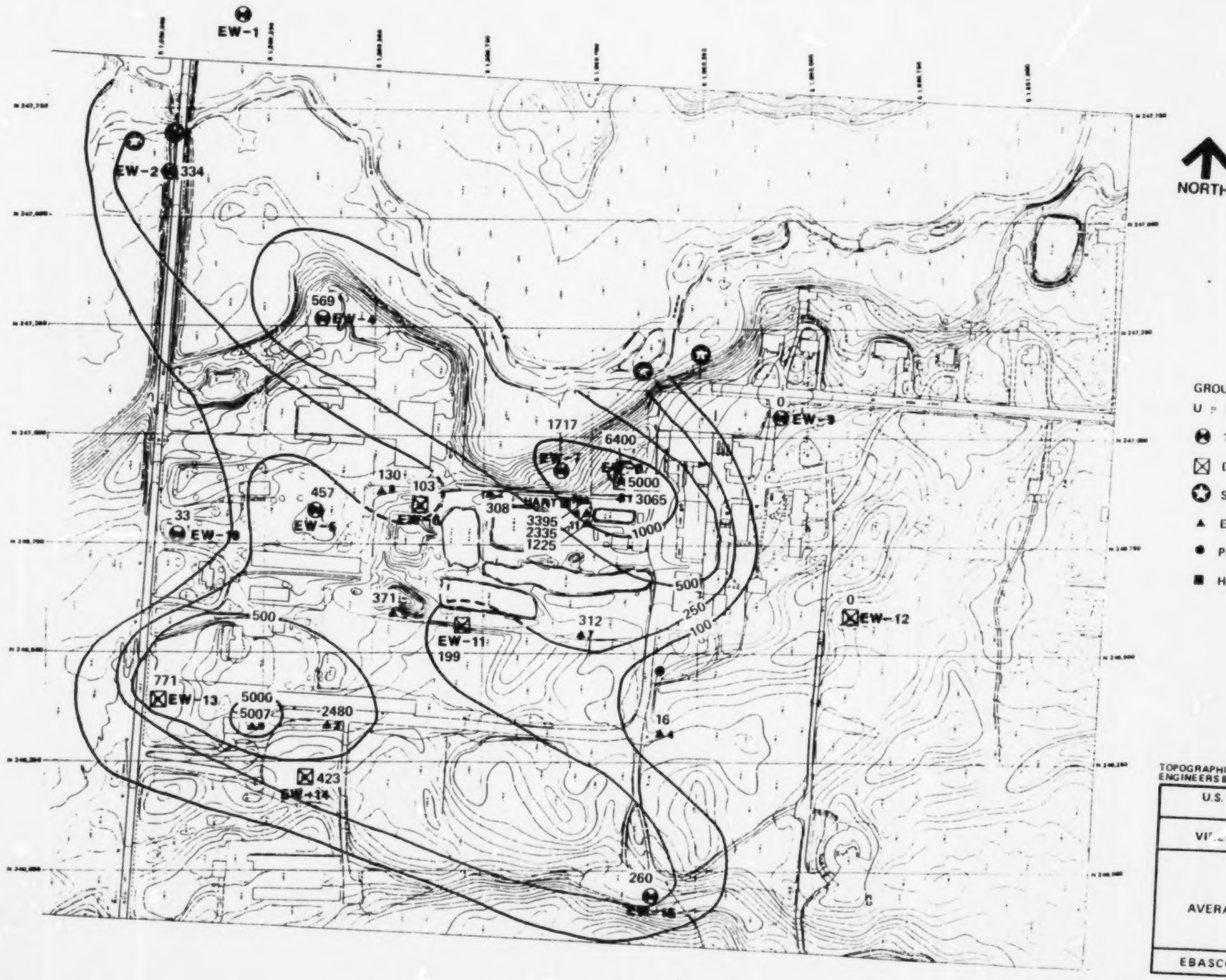
U.S. ENVIRONMENTAL PROTECTION AGENCY

VINELAND CHEMICAL COMPANY SITE

FIGURE 3

SURFACE SOIL
ARSENIC CONCENTRATIONS

EBASCO SERVICES INCORPORATED


NORTH
EW-1
EW-2
334
569
EW-4
0
EW-3
1717
6400
EW-7
5000
3065
1000
HART
308
3395
2335
1225
130
103
457
EW-5
33
EW-10
371
500
EW-11
199
312
250
100
0
EW-12
771
EW-13
5000
5007
2480
423
EW-14
16
260
EW-15

GROUNDWATER (AS): ppb
U = UNDETECTED

- TRIPLE WELL CLUSTER (8)
- ☒ DOUBLE WELL CLUSTER (6)
- STREAM GAUGE STATIONS
- ▲ EXISTING MONITORING WELLS (11)
- ● PRODUCTION WELL (1)
- ■ HART WELL (1)

0 100 200 300
SCALE IN FEET

TOPOGRAPHIC BASE PREPARED FOR U.S. ARMY CORPS O
ENGINEERS BY KUCERA INTERNATIONAL, JANUAPY 198

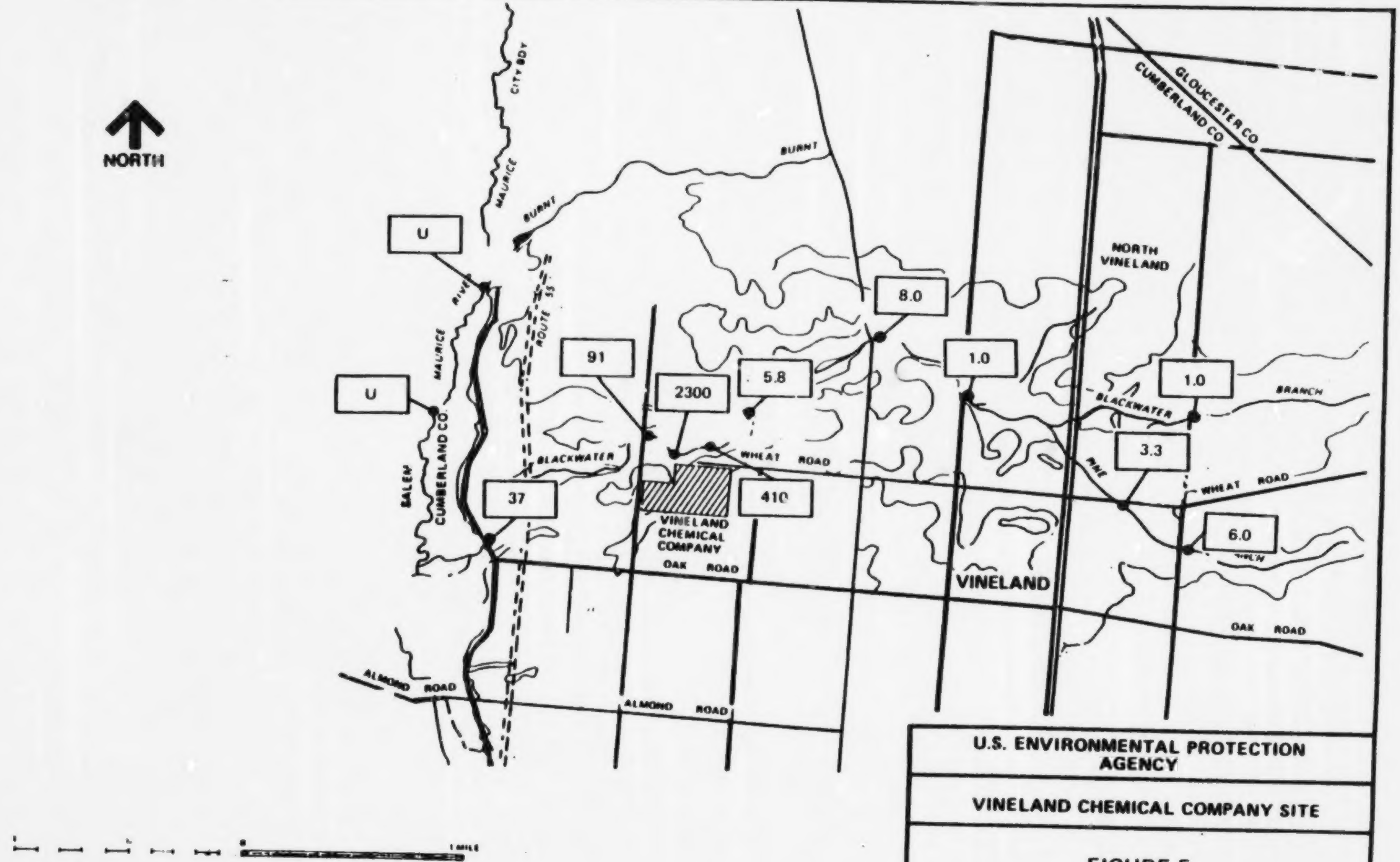
U.S. ENVIRONMENTAL PROTECTION AGENCY

VINELAND CHEMICAL COMPANY SITE

FIGURE 4

AVERAGE ARSENIC CONCENTRATION SHALLOW WELLS

EBASCO SERVICES INCORPORATED


NORTH
U
U
37
91
2300
5.8
410
8.0
1.0
1.0
3.3
6.0
MAURICE
CITY BOY
BURNT
BURNT
MAURICE RIVER
ROUTE 55
SALEM
CUMBERLAND CO.
BLACKWATER
BLACKWATER
BRANCH
PINE
VINELAND CHEMICAL COMPANY
WHEAT ROAD
WHEAT ROAD
OAK ROAD
OAK ROAD
ALMOND ROAD
ALMOND ROAD
VINELAND
NORTH VINELAND
GLOUCESTER CO
CUMBERLAND CO
1 MILE

KEY:
SURFACE SEDIMENT [AS] = ppm
U = UNDETECTED
X = REJECTED DATA

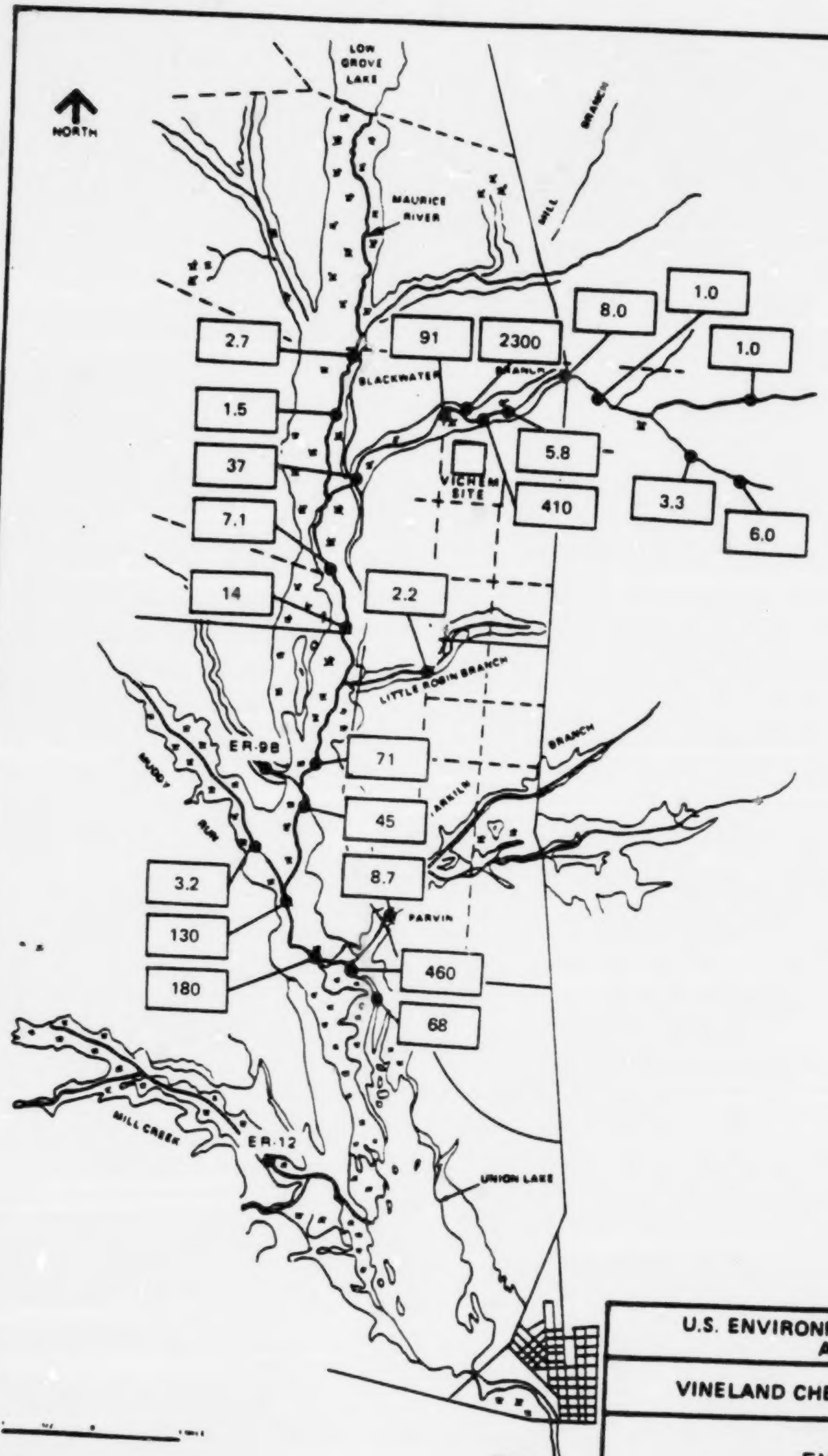
U.S. ENVIRONMENTAL PROTECTION AGENCY

VINELAND CHEMICAL COMPANY SITE

FIGURE 5

MEAN SURFACE SEDIMENT ARSENIC RESULTS
BLACKWATER BRANCH
PHASE II

EBASCO SERVICES INCORPORATED


NORTH
LOW GROVE LAKE
MILL BRANCH
MAURICE RIVER
2.7
91
2300
8.0
1.0
1.0
BLACKWATER
BRANCH
1.5
5.8
37
VICHEM SITE
410
3.3
6.0
7.1
14
2.2
LITTLE ROBIN BRANCH
ER-9B
71
BRANCH
MUDDY RUN
45
ARKILN
3.2
8.7
PARVIN
130
460
180
68
MILL CREEK
ER-12
UNION LAKE
MAURICE RIVER

KEY:

SURFACE SEDIMENT [AS] = ppm
U = UNDETECTED
X = REJECTED DATA

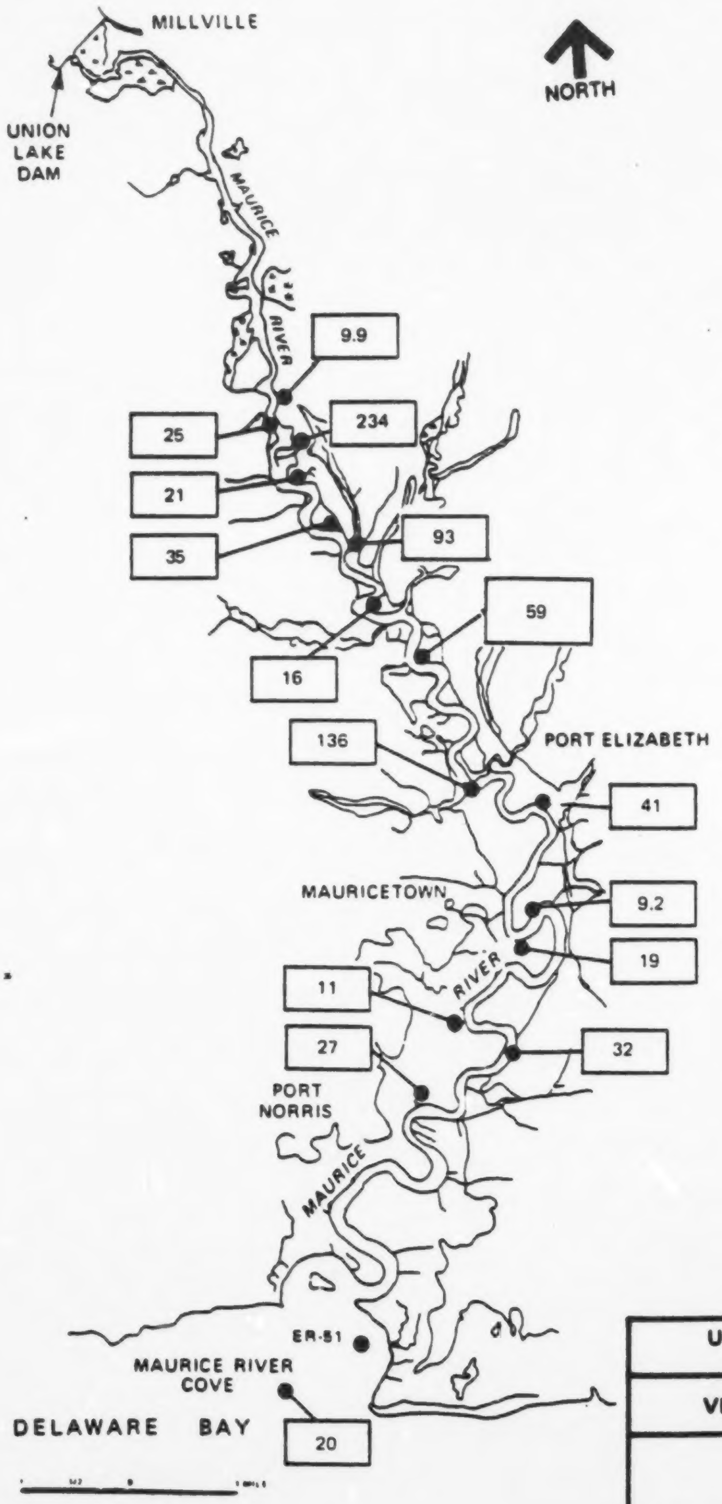
U.S. ENVIRONMENTAL PROTECTION AGENCY

VINELAND CHEMICAL COMPANY SITE

FIGURE 6

MEAN SURFACE SEDIMENT ARSENIC RESULTS
NORTH OF UNION LAKE
PHASE II

EBASCO SERVICES INCORPORATED


MILLVILLE
NORTH
UNION LAKE DAM
MAURICE RIVER
9.9
25
234
21
93
35
59
16
136
PORT ELIZABETH
41
MAURICETOWN
9.2
19
11
27
32
PORT NORRIS
MAURICE RIVER
ER-51
MAURICE RIVER COVE
DELAWARE BAY
20

KEY:
SURFACE SEDIMENT [AS] = ppm
U = UNDETECTED
X = REJECTED DATA

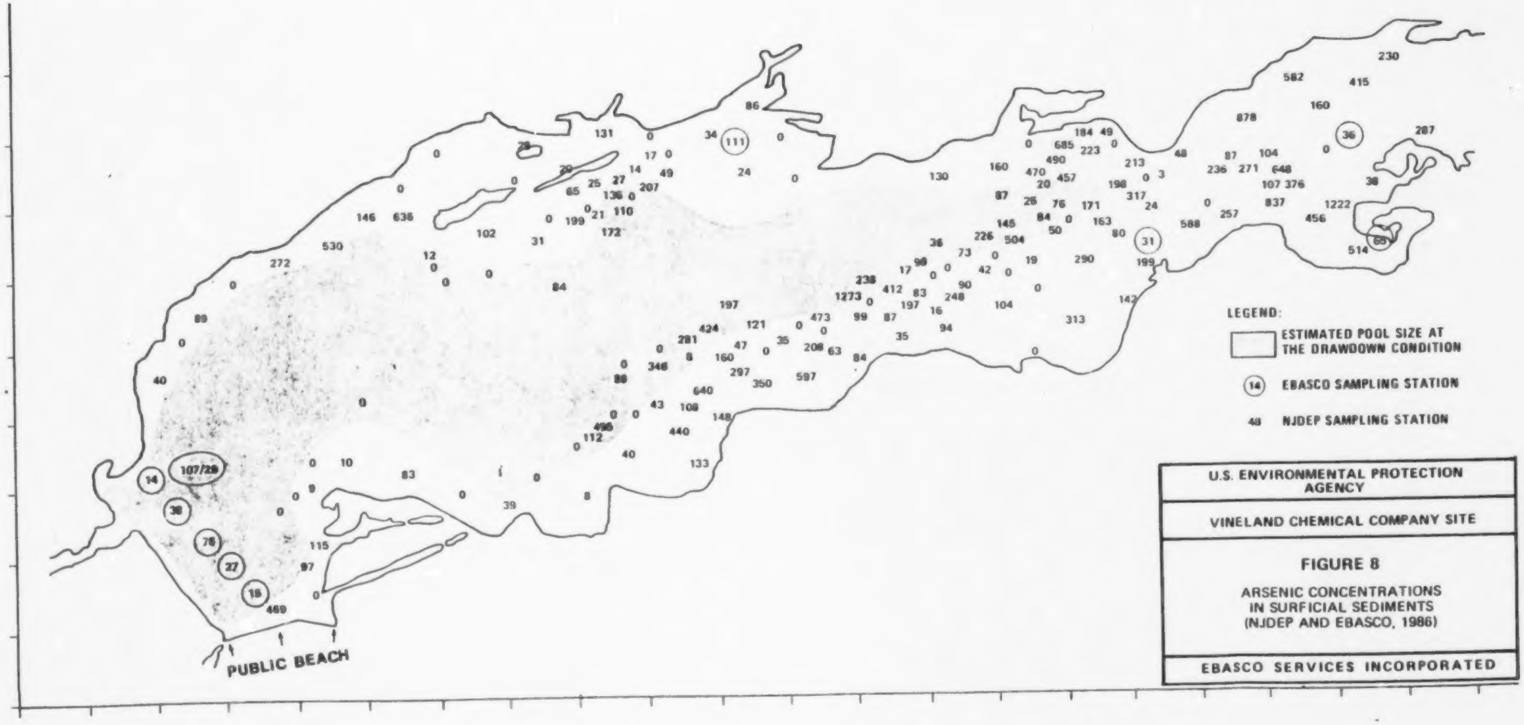
U.S. ENVIRONMENTAL PROTECTION AGENCY

VINELAND CHEMICAL COMPANY SITE

FIGURE 7

SURFACE SEDIMENT ARSENIC RESULTS
SOUTH OF UNION LAKE
PHASE II

EBASCO SERVICES INCORPORATED


LEGEND:
ESTIMATED POOL SIZE AT THE DRAWDOWN CONDITION
⑭ EBASCO SAMPLING STATION
48 NJDEP SAMPLING STATION
PUBLIC BEACH
14
107/28
38
76
27
18
469
111
31
36
230
582
415
160
287
878
104
1222
514
1273
597
640

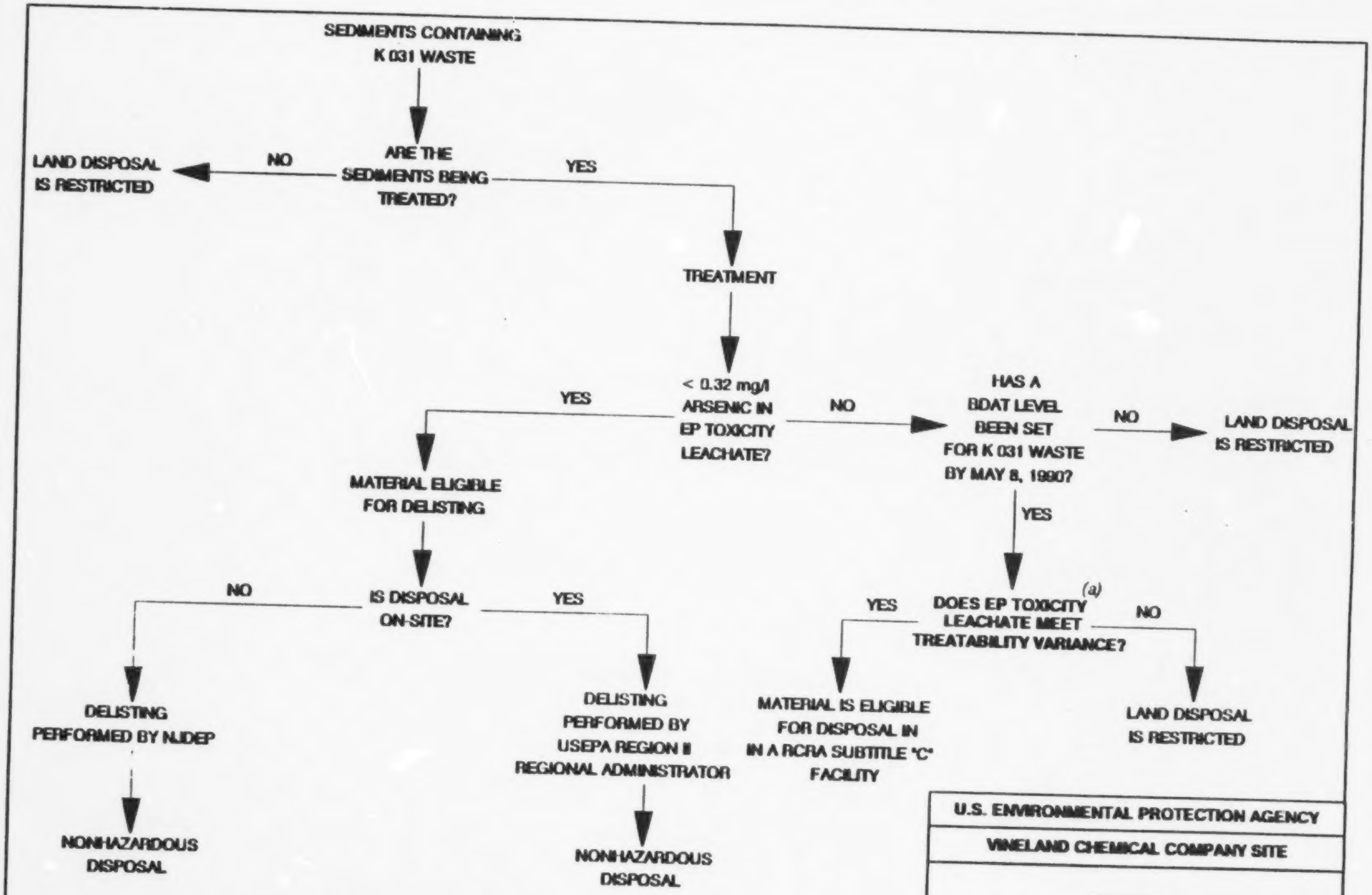
U.S. ENVIRONMENTAL PROTECTION AGENCY

VINELAND CHEMICAL COMPANY SITE

FIGURE 8

ARSENIC CONCENTRATIONS
IN SURFICIAL SEDIMENTS
(NJDEP AND EBASCO, 1986)

EBASCO SERVICES INCORPORATED


SEDIMENTS CONTAINING K 031 WASTE
ARE THE SEDIMENTS BEING TREATED?
NO
LAND DISPOSAL IS RESTRICTED
YES
TREATMENT
< 0.32 mg/l ARSENIC IN EP TOXICITY LEACHATE?
YES
MATERIAL ELIGIBLE FOR DELISTING
IS DISPOSAL ON-SITE?
NO
DELISTING PERFORMED BY NJDEP
NONHAZARDOUS DISPOSAL
YES
DELISTING PERFORMED BY USEPA REGION II REGIONAL ADMINISTRATOR
NONHAZARDOUS DISPOSAL
NO
HAS A BDAT LEVEL BEEN SET FOR K 031 WASTE BY MAY 8, 1990?
NO
LAND DISPOSAL IS RESTRICTED
YES
DOES EP TOXICITY LEACHATE MEET TREATABILITY VARIANCE? (a)
YES
MATERIAL IS ELIGIBLE FOR DISPOSAL IN IN A RCRA SUBTITLE "C" FACILITY
NO
LAND DISPOSAL IS RESTRICTED

(a) A TREATABILITY VARIANCE WILL BE ESTABLISHED, IF NECESSARY, DURING DESIGN BASED ON DATA FROM PILOT-SCALE STUDIES.

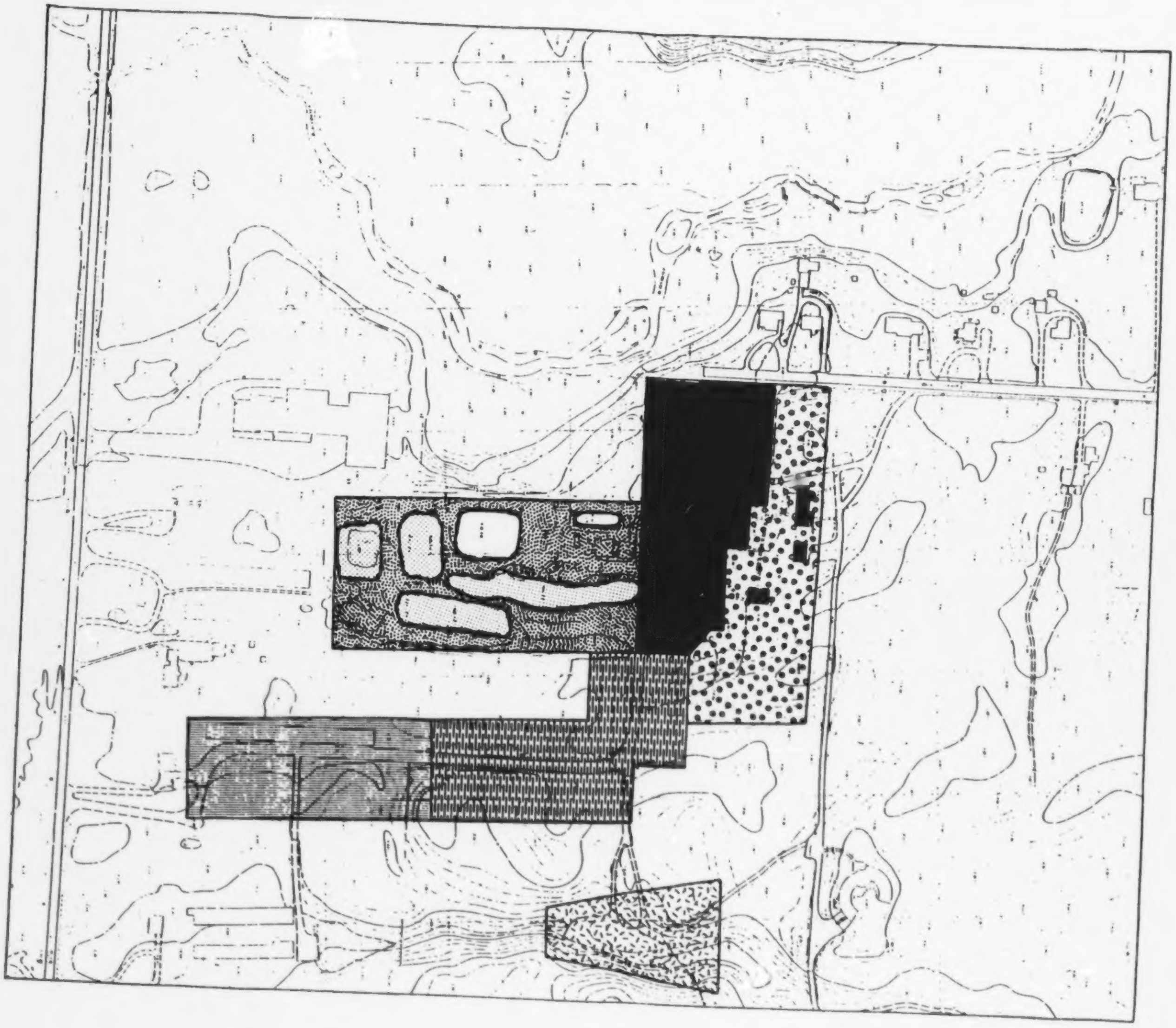
U.S. ENVIRONMENTAL PROTECTION AGENCY

VINELAND CHEMICAL COMPANY SITE

FIGURE 9

RCRA DISPOSAL CONSIDERATIONS

EBASCO SERVICES INCORPORATED



LEGEND :

- ▨ ZONE 1–CONTAMINATION TO A DEPTH OF 2'
- ▨ ZONE 2–CONTAMINATION TO A DEPTH OF 6'
- ▨ ZONE 3–CONTAMINATION TO A DEPTH OF 6'
- ▤ ZONE 4–CONTAMINATION TO A DEPTH OF 8'
- ▨ ZONE 5–CONTAMINATION TO A DEPTH OF 10'
- ▒ ZONE 5 –CONTAMINATION TO A DEPTH OF 5'
- ■ AREAS OF NON–EXCAVATION
- □ ACTIVE LINED LAGOONS

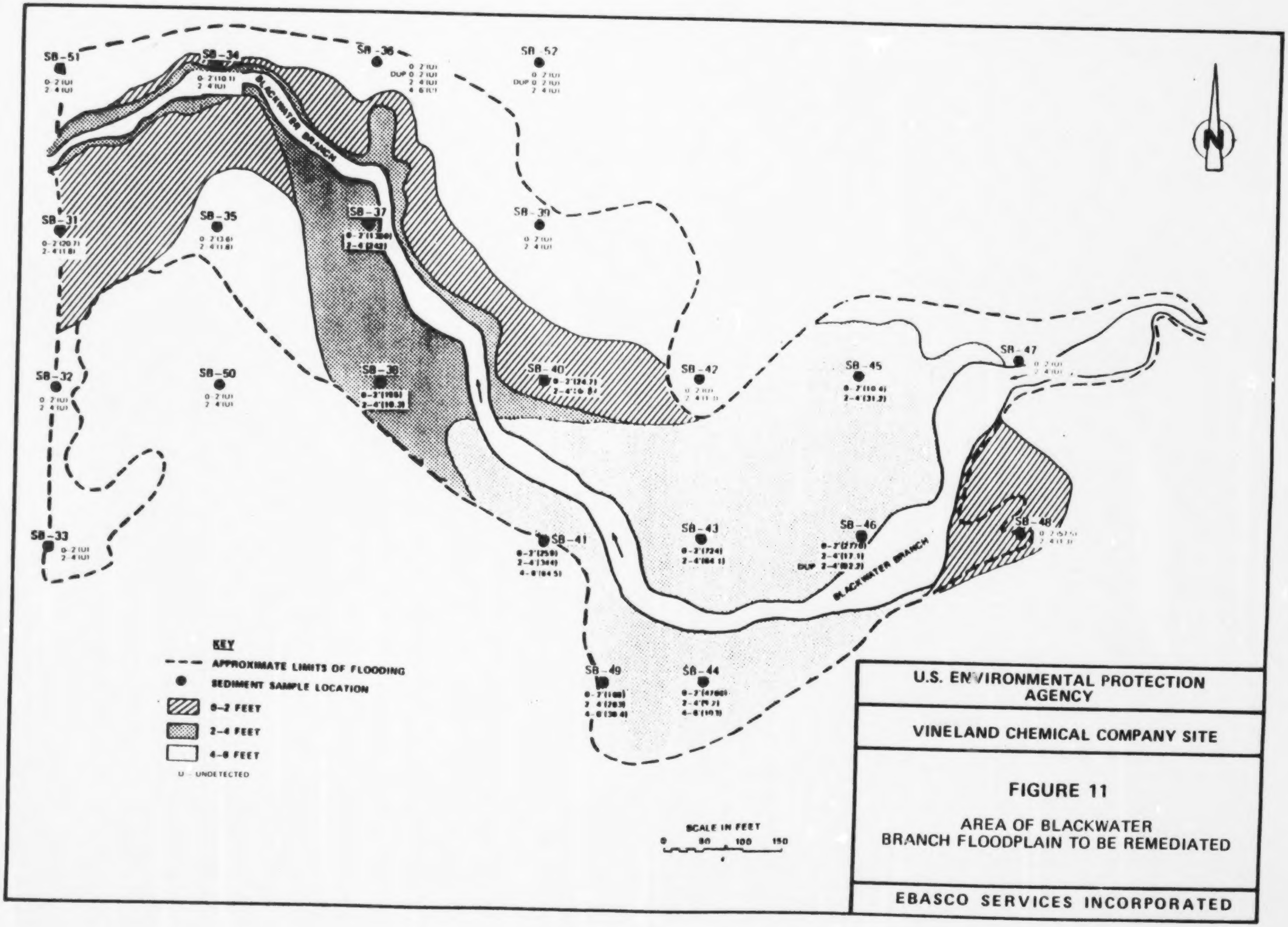
U.S. ENVIRONMENTAL PROTECTION AGENCY

VINELAND CHEMICAL COMPANY SITE

FIGURE 10

ZONES OF SOIL CONTAMINATION

EBASCO SERVICES INCORPORATED


SB-51
0-2 (U)
2-4 (U)
SB-34
0-2' (10.1)
2-4' (U)
BLACKWATER BRANCH
SB-36
0-2' (U)
DUP 0-2 (U)
2-4 (U)
4-6 (U)
SB-52
0-2 (U)
DUP 0-2 (U)
2-4 (U)
SB-31
0-2 (20.7)
2-4 (1.8)
SB-35
0-2 (3.6)
2-4 (1.8)
SB-37
0-2' (1,300)
2-4 (242)
SB-39
0-2 (U)
2-4 (U)
SB-32
0-2' (U)
2-4 (U)
SB-50
0-2' (U)
2-4' (U)
SB-38
0-2' (100)
2-4' (10.3)
SB-40
0-2' (24.7)
2-4' (6.8)
SB-42
0-2 (U)
2-4 (1.1)
SB-45
0-2' (10.4)
2-4' (31.2)
SB-47
0-2 (U)
2-4 (U)
SB-33
0-2 (U)
2-4 (U)
SB-41
0-2' (259)
2-4' (344)
4-6' (64.5)
SB-43
0-2' (724)
2-4' (64.1)
SB-46
0-2' (277)
2-4' (17.1)
DUP 2-4' (82.2)
BLACKWATER BRANCH
SB-48
0-2 (57.5)
2-4 (1.1)
SB-49
0-2' (100)
2-4 (263)
4-6 (30.4)
SB-44
0-2' (4700)
2-4' (9.7)
4-6' (10.1)
KEY
APPROXIMATE LIMITS OF FLOODING
SEDIMENT SAMPLE LOCATION
0-2 FEET
2-4 FEET
4-6 FEET
U - UNDETECTED
SCALE IN FEET
0
50
100
150
N

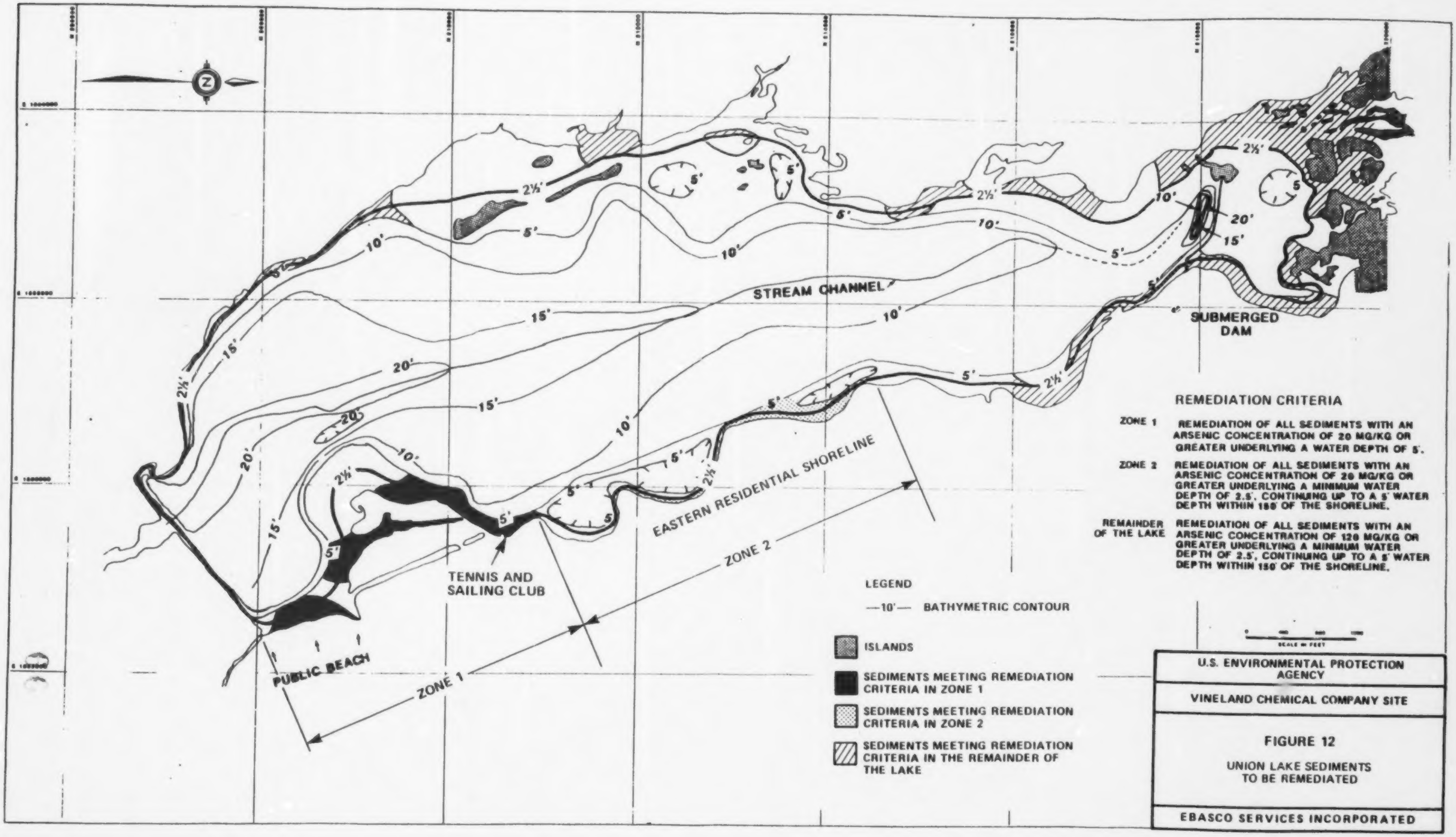
U.S. ENVIRONMENTAL PROTECTION AGENCY

VINELAND CHEMICAL COMPANY SITE

FIGURE 11

AREA OF BLACKWATER BRANCH FLOODPLAIN TO BE REMEDIATED

EBASCO SERVICES INCORPORATED



2½'
5'
10'
15'
20'
STREAM CHANNEL
SUBMERGED DAM
EASTERN RESIDENTIAL SHORELINE
TENNIS AND SAILING CLUB
PUBLIC BEACH
ZONE 1
ZONE 2
LEGEND
—10'— BATHYMETRIC CONTOUR
ISLANDS
SEDIMENTS MEETING REMEDIATION CRITERIA IN ZONE 1
SEDIMENTS MEETING REMEDIATION CRITERIA IN ZONE 2
SEDIMENTS MEETING REMEDIATION CRITERIA IN THE REMAINDER OF THE LAKE
SCALE IN FEET

REMEDIATION CRITERIA

ZONE 1 REMEDIATION OF ALL SEDIMENTS WITH AN ARSENIC CONCENTRATION OF 20 MG/KG OR GREATER UNDERLYING A WATER DEPTH OF 5'.

ZONE 2 REMEDIATION OF ALL SEDIMENTS WITH AN ARSENIC CONCENTRATION OF 20 MG/KG OR GREATER UNDERLYING A MINIMUM WATER DEPTH OF 2.5', CONTINUING UP TO A 5' WATER DEPTH WITHIN 150' OF THE SHORELINE.

REMAINDER OF THE LAKE REMEDIATION OF ALL SEDIMENTS WITH AN ARSENIC CONCENTRATION OF 120 MG/KG OR GREATER UNDERLYING A MINIMUM WATER DEPTH OF 2.5', CONTINUING UP TO A 5' WATER DEPTH WITHIN 150' OF THE SHORELINE.

U.S. ENVIRONMENTAL PROTECTION AGENCY

VINELAND CHEMICAL COMPANY SITE

FIGURE 12

UNION LAKE SEDIMENTS
TO BE REMEDIATED

EBASCO SERVICES INCORPORATED

TABLE 1

PREVIOUS INVESTIGATIONS AT THE VINELAND CHEMICAL COMPANY SITE

DATE	ACTIVITY
1978	Vineland Chemical Company commissioned a surface geophysical survey of the plant site at the direction of NJDEP.
1979-1980	NJDEP initiated a sampling program in the Blackwater Branch and the Maurice River.
1979	NJDEP collected soil samples from the plant site area.
1981	NJDEP performed a surface geophysical survey of the plant site.
1982	Vineland Chemical Company commissioned a groundwater investigation at the plant site.
1982	New Jersey Department of Health conducted a "Cross-Sectional Evaluation of Arsenic Exposure and Toxicity at the Vineland Chemical Company".
1982	Vineland Chemical Company commissioned a pumping test to be performed on the shallow aquifer underlying the plant site.
1980-1982	Studies conducted by NJDEP and Rutgers University to determine any seasonal chemical stratification of Union Lake.
1983-1985	Rutgers University conducted study to determine speciation of arsenic in Union Lake.
1986	Vineland Chemical commissioned a pumping test to be performed in the deeper groundwater below the site.
March 1988	USEPA's Environmental Photographic Information Center (EPIC) produced a report presenting an aerial photographic analysis of the Vineland Chemical Company plant site and surrounding area.
1988	USEPA's Environmental Response Team prepared a bioassessment on the Blackwater Branch and the Upper Maurice River.

TABLE 2

RI AND FS REPORTS PREPARED FOR THE VINELAND CHEMICAL COMPANY SITE

TITLE	AREAS	MEDIA INVESTIGATED	DRAFT	REVISED DRAFT	FINAL DRAFT
Plant Site RI	ViChem Plant Site	Soil, Groundwater	7/19/88	3/10/89	6/23/89
River Areas RI	Blackwater Branch, Maurice River between Blackwater Branch and Union Lake, Maurice River below Union Lake to Delaware Bay	Sediment, Surface Water, Biota	9/8/88	2/17/89	6/23/89
Union Lake RI[1]	Union Lake	Sediment, Surface Water, Biota	6/21/88	4/28/89	6/23/89
Plant Site FS	ViChem Plant Site	Soil, Groundwater	9/20/88	3/10/89	6/23/89
River Areas FS[2]	Blackwater Branch, Maurice River between Blackwater Branch and Union Lake	Sediment	10/5/88	4/27/89	6/23/89
Union Lake FS	Union Lake	Sediment	1/18/89	4/14/89	6/23/89

[1] Risk assessment submitted on April 20, 1987. First Draft RI submitted on March 13, 1988. The June 21, 1988 RI incorporated the first revised risk assessment.

[2] No FS Report is being prepared for the Maurice River below Union Lake. Sampling in this area was confirmational only.

TABLE 3

SUMMARY OF CHEMICALS DETECTED IN SOILS

SURFACE SOILS COMPOUND	MINIMUM DETECTED CONCENTRATION	MAXIMUM DETECTED CONCENTRATION
** Class: VOLATILES (ppb)		
Methylene chloride	5.2	5.2
Chloroform	2	6
** Class: BNA (ppb)		
Diethylphthalate	370	370
Butyl benzyl phthalate	760	840
Bis(2-ethylhexyl)phthalate	45	180
**Class: PEST/PCB (ppb)		
Dieldrin	39	39
4,4-DDT	20	39
**Class: INORGANICS (ppb)		
Aluminum	766	3260
Arsenic	0.43	650
Barium	2.3	12
Calcium	43	1150
Chromium	4	13
Copper	3	45
Iron	1230	4490
Lead	2	12
Magnesium	46	197
Manganese	4.6	35
Mercury	0.1	11.3
Nickel	8.8	26.4
Potassium	388	538.
Sodium	54	244.
Vanadium	6.6	8.4
Zinc	5.6	33.

SUBSURFACE SOILS

COMPOUND	MINIMUM DETECTED CONCENTRATION	MAXIMUM DETECTED CONCENTRATION
** Class: VOLATILES (ppb)		
Methylene chloride	1	113900
Acetone	60	270
Carbon disulfide	8	45
1,1-Dichloroethene	16	16
Chloroform	1	3

TABLE 3 (Cont'd)

SUMMARY OF CHEMICALS DETECTED IN SOILS

SUBSURFACE SOILS
VOLATILES (CONT'D)

COMPOUND	MINIMUM DETECTED CONCENTRATION	MAXIMUM DETECTED CONCENTRATION
2-Butanone	27000	285560
Trichloroethene	32	32
Benzene	2	52
Bromoform	1	2
4-Methyl-2-Pentanone	5	5
2-Hexanone	6	6
Tetrachloroethene	12	80
1,1,2,2-Tetrachloroethane	3	3
Toluene	5	3470
**Class: BNA (ppb)		
Benzoic acid	160	160
Diethylphthalate	60	480
Di-n-Buthylphthalate	330	560
Benzo(a)Anthracene	160	160
Bis(2-ethylhexyl)phthalate	40	1500
Chrysene	200	200
Di-n-octyl phthalate	460	460
Benzo(b)fluoranthene	550	550
**Class: PEST/PCB (ppb)		
Beta-BHC	13	17
Endosulfan I	8.2	8.2
4-4-DDE	0.18	0.18
Endrin	0.33	2.9
**Class: INORGANICS (ppm)		
Aluminum	145	5760
Antimony	35	39
Arsenic	0.581	482
Barium	1	40
Beryllium	0.2	0.2
Cadmium	0.6	1.06
Calcium	30	891
Chromium	2.4	34
Cobalt	3.4	14
Copper	1.8	24
Iron	472	25900
Lead	1.2	23

TABLE 3 (Cont'd)

SUMMARY OF CHEMICALS DETECTED IN SOILS

SUBSURFACE SOILS INORGANICS (CONT'D) COMPOUND (ppm)	MINIMUM DETECTED CONCENTRATION (ppm)	MAXIMUM DETECTED CONCENTRATION
Magnesium	49	282
Manganese	1.9	63
Mercury	0.1	1.2
Nickel	6.3	19
Potassium	104	940
Selenium	0.6	10
Silver	2.4	4.1
Sodium	44	4890
Vanadium	1.9	26
Zinc	2.8	49
BUILDING #9 SOILS		
**Class: VOLATILES (ppb)		
Methylene chloride	7	31
Acetone	15000	15000
Toluene	3	3
**Class: BNA (ppb)		
Di-n-Butylphthalate	97	690
**Class: INORGANICS (ppm)		
Aluminum	453	2223
Arsenic	7.50	1921
Barium	1	4
Chromium	2	5
Iron	1005	2293
Lead	3.8	3.8
Manganese	2	10
Sodium	533	2798
Vanadium	2.1	5.2
Zinc	6	48

TABLE 4

SUMMARY OF CHEMICALS DETECTED IN CHICKEN COOP DUST SAMPLES mg/kg

COMPOUND	MINIMUM DETECTED CONCEN-TRATION	MAXIMUM DETECTED CONCEN-TRATION
**Class: INORGANICS		
Aluminum	1680	3570
Antimony	4.3	55
Arsenic	114	5120
Barium	22	277
Beryllium	1.1	1.1
Cadmium	1.2	125
Calcium	17700	585000
Chromium	4.6	83
Cobalt	2.3	13
Copper	18	285
Iron	6240	118000
Lead	23	289
Magnesium	1480	3090
Manganese	138	567
Mercury	0.73	12.2
Nickel	20	108
Potassium	1900	4590
Selenium	0.16	0.7
Silver	4.3	4.7
Sodium	822	8980
Thallium	0.11	0.3
Vanadium	4.1	46
Zinc	370	1100

TABLE 5

SUMMARY OF CHEMICALS DETECTED IN GROUNDWATER

SHALLOW GROUNDWATER COMPOUND	MINIMUM DETECTED CONCENTRATION (ppb)	MAXIMUM DETECTED CONCENTRATION (ppb)
**CLASS: VOLATILES		
METHYLENE CHLORIDE	10	10
1,1-DICHLOROETHANE	2.7	2.7
CHLOROFORM	1	1
1,1,1-TRICHLOROETHANE	1.4	17
TRANS-1,3-DICHLOROPROPENE	43	43
TRICHLOROETHENE	1.3	1600
BROMOFORM	2.2	2.2
TETRACHLOROETHENE	0.5	4
1,1,2,2-TETRACHLOROETHANE	9.3	9.3
ETHYLBENZENE	0.5	0.6
TOTAL XYLENES	1.8	3.4
**CLASS: BNA		
DIETHYLPHTHALATE	4	4
DI-n-BUTYLPHTHALATE	0.4	0.4
BIS[2-EHTYLHEXYL] PHTHALATE	1.7	5.8
DI-n-OCTYL PHTHALATE	2	2
**CLASS: PEST/PCB		
BETA-BHC	0.09	0.09
GAMMA-BHC	3	13
HEPATCHLOR	12	12
ENDOSULFAN I	0.557	0.557
4-4-DDT	0.23	0.23
ENDRIN KETONE	0.03	0.21
**CLASS: INORGANICS		
ALUMINUM	33	334000
ANTIMONY	58	10400
ARSENIC	2.100	12600
BARIUM	3	224
BERYLLIUM	4	4

TABLE 5 (Cont'd)

SUMMARY OF CHEMICALS DETECTED IN GROUNDWATER

SHALLOW GROUNDWATER

COMPOUND	MINIMUM DETECTED CONCENTRATION (ppb)	MAXIMUM DETECTED CONCENTRATION (ppb)
CADMIUM	4	457
CALCIUM	605	11700
CHROMIUM	14.4	399
COBALT	9.4	90
COPPER	19.7	3050
IRON	6.02	430000
LEAD	2.9	3010
MAGNESIUM	180	8450
MANGANESE	21	1710
MERCURY	0.25	13.2
NICKEL	7.4	368
POTASSIUM	532	8140
SELENIUM	1.9	376
SILVER	51	51
SODIUM	1140	58000
VANADIUM	12.6	567
ZINC	19.3	686

INTERMEDIATE GROUNDWATER

COMPOUND	MINIMUM DETECTED CONCENTRATION (ppb)	MAXIMUM DETECTED CONCENTRATION (ppb)
**CLASS: VOLATILES		
ACETONE	170	180
CARBON DISULFIDE	17	17
1,1-DICHLOROETHANE	2.4	2.4
CHLOROFORM	1	6.7
1,1,1-TRICHLOROETHANE	2	3
CARBON TETRACHLORIDE	2	2
TRICHLOROETHENE	1	260
BENZENE	1.3	8
TETRACHLOROETHENE	0.2	0.2
**CLASS: BNA		

TABLE 5 (Cont'd)

SUMMARY OF CHEMICALS DETECTED IN GROUNDWATER

COMPOUND	MINIMUM DETECTED CONCENTRATION (ppb)	MAXIMUM DETECTED CONCENTRATION (ppb)
DIETHYLPHTHALATE	2	2
IDENO[1,2,3-CD]PYRENE	20	20
**CLASS: PEST/PCB		
GAMMA-BHC	6	6
HEPATCHLOR	0.584	0.584
ENDOSULFAN I	0.765	1.857
4-4-DDD	0.038	0.038
4-4-DDT	0.53	1.06
ENDRIN KETONE	0.02	0.37
AROCHLOR 1254	2.1	17
**CLASS: INORGANICS (ppm)		
ALUMINUM	94	5070
ANTIMONY	62	62
ARSENIC	4.4	394000
BARIUM	9.3	155
CADMIUM	6.4	9580
CALCIUM	1100	9950
CHROMIUM	92	14.8
COBALT	16	18
COPPER	17	82
IRON	388	38600
LEAD	3	110
MAGNESIUM	438	3400
MANGANESE	22	986
MERCURY	0.2	0.2
NICKEL	14	37
POTASSIUM	534	14000
SELENIUM	1.5	13
SILVER	60	60
SODIUM	2620	432000
ZINC	19.1	72
DEEP GROUNDWATER		
** CLASS: VOLATILES		
ACETONE	24	24
CHLOROFORM	2	2
CARBON TETRACHLORIDE	1.9	1.9

TABLE 5 (Cont'd)

SUMMARY OF CHEMICALS DETECTED IN GROUNDWATER

COMPOUND	MINIMUM DETECTED CONCENTRATION (ppb)	MAXIMUM DETECTED CONCENTRATION (ppb)
DEEP GROUNDWATER		
** CLASS: BNA		
BIS(2-ETHYLHEXYL) PHTHALATE	2.4	2.4
** CLASS: PEST PCB		
4-4-DDT	0.38	0.38
ENDRIN KETONE	0.12	0.28
** CLASS: INORGANICS		
ALUMINUM	495	4580
ANTIMONY	330	330
ARSENIC	4	34
BARIUM	26	280
CADMIUM	4.9	4.9
CALCIUM	708	57900
CHROMIUM	14	36.4
COPPER	52.6	82.9
IRON	470	4970
LEAD	3.6	99.3
MAGNESIUM	180	3860
MANGANESE	11	93.8
MERCURY	0.26	0.26
NICKEL	35	67
POTASSIUM	605	52700
SILVER	7	7
SODIUM	4540	236000
ZINC	21	78.1

TABLE 6

SUMMARY OF CHEMICALS DETECTED
SURFACE WATER
PHASE II

COMPOUND	MINIMUM DETECTED CONCENTRATION	MAXIMUM DETECTED CONCENTRATION
**CLASS: VOLATILES (ug/l)		
Methyl Chloride	4.0	4.0
Trans-1,2-Dichloroethene	9.0	9.0
Trichloroethene	2.0	11.0
Benzene	4.0	4.0
4-Methyl-2-Pentanone	3.0	4.0
Di-n-Butylphthalate	2.0	2.0
Bis[2-Ethlhexyl]Phthalat	0.6	6.0
Di-n-Octyl Phthalate	8.0	8.0
Gamma-BHC	0.004	0.004
**CLASS: INORGANICS (ug/l)		
Aluminum	132.0	1110.0
Antimony	18.0	38.0
Arsenic	2.2	6200.0
Barium	32.0	148.0
Beryllium	2.4	2.4
Cadmium	4.6	4.6
Calcium	3170.0	207000.0
Chromium	7.7	56.0
Cobalt	51.0	66.0
Copper	11.0	87.0
Iron	124.0	3660.0
Lead	2.3	29.4
Magnesium	1600.0	591000.0
Manganese	18.3	129.0
Mercury	0.2	0.8
Nickel	7.9	112.0
Potassium	405.0	232000.0
Selenium	0.5	2.4
Silver	9.6	35.0
Sodium	3580.0	6092000.0
Thallium	0.6	1.3
Vanadium	6.5	60.0
Zinc	8.0	74.1

TABLE 7

SUMMARY OF CHEMICALS DETECTED IN SURFACE SEDIMENTS: 0-1 FT. SAMPLES
PHASE II

COMPOUND	MINIMUM DETECTED CONCENTRATION	MAXIMUM DETECTED CONCENTRATION
**CLASS: VOLATILES (ug/kg)		
Methyl Chloride	3	3
Carbon Disulfide	4	4
2-Butanone	3	13
Toluene	3	260
**CLASS: BNA (ug/kg)		
Bis[2-Chloroethyl]Ether	860	860
Benzoic Acid	310	310
Acenaphthylene	67	83
Acenaphthene	450	450
Dibenzofuran	350	350
Diethylpthalate	42	67
Fluorene	620	620
Phenanthrene	150	2100
Anthracene	170	350
Di-n-Butylphthalate	42	67
Fluoranthrene	30	1100
Pyrene	32	1200
Benzo[a]Anthracene	110	200
Chrysene	190	670
Benzo[b]Fluoranthene	210	370
Benzo[a]Pyrene	150	170
Indeno[1,2,3-CD]Pyrene	83	83
Benzo[G,H,I]Perylene	83	83
** CLASS: PEST/PCB (ug/kg)		
Gamma-BHC	230	230
4-4-DDD	13	45
Endosulfan Sulfate	23	23
4-4-DDT	32	32

TABLE 7 (Cont'd)

SUMMARY OF CHEMICALS DETECTED IN SURFACE SEDIMENTS: 0-1 FT. SAMPLES PHASE II

COMPOUND	MINIMUM DETECTED CONCENTRATION	MAXIMUM DETECTED CONCENTRATION
**CLASS: INORGANICS (mg/kg)		
Aluminum	262	25965
Arsenic	1	3760
Barium	9	810
Beryllium	1.6	1.6
Cadmium	1.2	12.0
Calcium	10.0	5480.0
Chromium	3.1	6.8
Cobalt	6.0	119.0
Iron	80.0	39000.0
Lead	1.9	337.0
Magnesium	64.0	1440.0
Manganese	7.2	102.0
Mercury	0.2	2.7
Nickel	1.5	17.0
Potassium	380.0	380.0
Silver	4.4	4.4
Sodium	337.0	846.0
Vanadium	4.1	49.9
Zinc	4.1	162.0

TABLE 8

CONCENTRATION RANGES (ug/l) OF TOTAL, DISSOLVED AND PARTICULATE ARSENIC IN UNION LAKE WATER SAMPLES

	Dissolved As	Particulate As	Total As
NJDEP (September, 1982-1983)			
Upper Lake water	-	-	36 - 267
Mid-Lake water	-	-	27 - 100
Lower Lake water	-	-	33 - 194
PHASE I (June - July, 1986)			
Upper Lake water (EL-1, EL-2)	44(R) - 50(R)	16 - 21	65(R) - 66(R)
Mid-Lake water	48 - 67	3.8 - 9.9	54 - 71
Lower Lake water (EL-9 through EL-13)	48 - 75	5 - 10.2	54 - 81
PHASE II (January, 1987)			
Upper Lake water (EL-28 through EL-30)	21 - 41	NA	20 - 187
Mid-Lake water	10 - 22	NA	11 - 26
Lower Lake water (EL-9 through EL-13)	14 - 16	NA	12 - 126

NA - Not Applicable or Available
(R) - Rejected value

TABLE 9

CONCENTRATION RANGES (mg/kg) OF TOTAL ARSENIC LEVELS IN UNION LAKE SEDIMENT SAMPLES

NJDEP SAMPLING (August, 1986)

	Total As
Lakeshore sediments in less than 10 feet of water (193 sample locations)	0 - 1273

PHASE I (June - July, 1986)

Upper Lake sediment (EL-1, EL-2)	36 - 65
Mid-Lake sediment (EL-5)	12
Lower Lake sediment (EL-9 through 13)	14 - 107

TABLE 10

REMEDIATION ARSENIC CLEANUP GOALS

	CLEANUP GOAL
o PLANT SITE	
o Soils	20 mg/kg
o Groundwater	50 ug/l
o RIVER AREAS	
o Exposed Sediment	20 mg/kg
o Submerged Sediment	120 mg/kg
o UNION LAKE	
o Submerged Sediment	120 mg/kg

TABLE 11

OPERABLE UNIT ONE (PLANT SITE SOURCE CONTROL)

SUMMARY OF EVALUATIONS AND COST INFORMATION FOR EACH ALTERNATIVE

ASSESSMENT FACTORS	ALTERNATIVE SC-1 NO ACTION	ALTERNATIVE SC-2 MULTILAYER CAPPING SYSTEM	ALTERNATIVE SC-3A EXCAVATION/FIXATION/ OFF-SITE NONHAZARDOUS LANDFILL	ALTERNATIVE SC-3B EXCAVATION/FIXATION/ ON-SITE NONHAZARDOUS LANDFILL
Short-Term Effectiveness				
- Protection of community during remedial actions	No short-term threats to communities	Potential for direct contact of spilled waste and inhalation of fugitive dust	Same as Alternative SC-2	Same as Alternative SC-2
- Protection of workers during remediation	Personnel protection equipment required against dermal contact and inhalation during sign posting and inspection	Minimal risk to workers. Personnel protection equipment required against direct contact with wastes and inhalation of fugitive dust.	Same as Alternative SC-2	Same as Alternative SC-2
- Environmental impacts	No temporary adverse environmental impacts	Increase in traffic, noise and air pollution	Same as Alternative SC-2	Minimal increase in traffic noise and air pollution.
- Time until remediation	Many years (probably decades)	Estimated to be 1 year from start of construction to completion of remediation work.	Same as Alternative SC-2	Same as Alternative SC-2
Long-Term Effectiveness				
- Magnitude of residual risks	Existing impacts on the environment from the contaminated soils would continuously persist. Significant risk to human health remains from potential contact with contaminated soils.	Significant reductions in environmental impacts due to containment of contaminants and reduction of leachate to the groundwater. Significant reduction in risk to human health from potential contact with contaminated soils.	Due to removal and treatment of contaminated soils, environmental impacts would be eliminated. Treatment of soils to below health-risk based levels.	Same as Alternative SC-3A
- Adequacy of control	Depends on success in preventing access to site	Requires long-term monitoring and 5-year reviews. Always potential for failure.	Proven technologies	Proven technologies. Long-term landfill maintenance is required.
- Reliability of controls	Signs would have to be replaced	Periodic cap maintenance is required. Liners might have to be replaced.	Technologies are highly reliable.	Same as Alternative SC-3A

TABLE 11 (Cont'd)

OPERABLE UNIT ONE (PLANT SITE SOURCE CONTROL)

SUMMARY OF EVALUATIONS AND COST INFORMATION FOR EACH ALTERNATIVE

ASSESSMENT FACTORS	ALTERNATIVE SC-3C EXCAVATION/FIXATION/ ON-SITE REDEPOSITION	ALTERNATIVE SC-4A EXCAVATION/EXTRACTION/ SOILS TO OFF-SITE NON-HAZARDOUS LANDFILL/OFF-SITE HAZARDOUS SLUDGE DISPOSAL	ALTERNATIVE SC-4B EXCAVATION/EXTRACTION/SOILS TO ON-SITE NONHAZARDOUS LANDFILL/OFF-SITE HAZARDOUS SLUDGE DISPOSAL	ALTERNATIVE SC-4C EXCAVATION/EXTRACTION/ ON-SITE REDEPOSITION OF SOILS/OFF-SITE HAZARDOUS SLUDGE DISPOSAL
Short-Term Effectiveness				
- Protection of community during remedial actions	Potential for direct contact of spilled waste and inhalation of fugitive dust	Same as Alternative SC-3C	Same as Alternative SC-3C	Same as Alternative SC-3C
- Protection of workers during remedial actions	Minimal risk to workers. Personnel protection equipment required to protect against direct contact with wastes and inhalation of fugitive dust.	Same as Alternative SC-3C	Same as Alternative SC-3C	Same as Alternative SC-3C
- Environmental impacts	Minimal increase in traffic, noise and air pollution	Increased traffic, noise and air pollution	Same as Alternative SC-3C	Same as Alternative SC-3C
- Time until remediation	Estimated to be 1 year from start of construction to completion of remediation work	Estimated to be 2 years from start of construction to completion of remediation work	Same as Alternative SC-4A	Same as Alternative SC-4A
Long-Term Effectiveness				
- Magnitude of residual risks	Due to removal and treatment of contaminated soils, environmental impacts would be minimized. Failure of treatment could result in groundwater contamination since redeposition areas are not lined. Treatment of soils to below health-risk based levels.	All contaminated soils treated to below health-risk based levels and removed from the site.	Contaminated soils treated to acceptable risk levels and disposed in a controlled on-site landfill.	Same as Alternative SC-4B except redeposition areas are not controllable environments. Potential for failure is low.
- Adequacy of control	Proven technologies. Redeposition areas covered with seeded soil for erosion.	Proven technologies	Proven technologies. Long-term landfill maintenance is required	Same as Alternative SC-3C
- Reliability of controls	Techniques are highly reliable	Same as Alternative SC-3C	Same as Alternative SC-3C	Same as Alternative SC-3C

TABLE 11 (Cont'd)

OPERABLE UNIT ONE (PLANT SITE SOURCE CONTROL)

SUMMARY OF EVALUATIONS AND COST INFORMATION FOR EACH ALTERNATIVE

ASSESSMENT FACTORS	ALTERNATIVE SC-5 IN SITU SOIL FLUSHING	ALTERNATIVE SC-6 IN SITU SOLIDIFICATION/ FIXATION OF UNSATURATED ZONE SOILS
Short-Term Effectiveness		
- Protection of community during remedial actions	Minimal risk to community from in situ treatment	Same as Alternative SC-5
- Protection of workers during removal actions	Minimal risk to workers. Personnel protection equipment required to protect against direct contact with wastes and inhalation of fugitive dust.	Same as Alternative SC-5
- Environmental impacts	Leach fields must be maintained for 8 years. Dust generated during initial excavation operations.	No increase in dust
- Time until remediation	Approximately 8 years are required to extract arsenic from the soils in situ	Estimated to be 2 years from start of construction to completion of remediation work
Long-Term Effectiveness		
- Magnitude of residual risks	Residual risks are minimized by treating the contaminated soils to acceptable health-risk based levels. In situ treatment does not provide any control of leaching after completion of remediation.	Same as Alternative SC-5
- Adequacy of control	Minimal control of leach-fields other than public deterrents. Arsenic must be allowed to leach into groundwater to be treated downgradient.	Proven technologies. Failure of treatment could result in groundwater contamination, since liners and caps associated with a landfill are not used.
- Reliability of controls	Reliability of technology would be dependent on efficiency of groundwater treatment system	Technologies are highly reliable.

TABLE 11 (Cont'd)

OPERABLE UNIT ONE (PLANT SITE SOURCE CONTROL)

SUMMARY OF EVALUATIONS AND COST INFORMATION FOR EACH ALTERNATIVE

ASSESSMENT FACTORS	ALTERNATIVE SC-1	ALTERNATIVE SC-2	ALTERNATIVE SC-3A	ALTERNATIVE SC-3B
Reduction of Toxicity, Mobility or Volume				
- Treatment process and remedy	No reduction in toxicity, mobility and volume	No reduction in toxicity or volume. Reduction in mobility because the cap would prevent further leaching of contaminants and migration off-site.	Reduction in mobility of contaminants due to fixation process. No reduction in volume or toxicity of contaminants. However, fixated soils removed off-site.	Same as Alternative SC-3A except fixated soils remain on-site.
- Amount of hazardous materials remaining	No material treated or removed	Same as Alternative SC-1	All hazardous materials bound within a fixated matrix and removed off-site.	All hazardous materials bound within a fixated matrix.
- Irreversibility of the treatment	N/A	N/A	Treatment is essentially irreversible	Same as Alternative SC-3A
- Type and quantity of residual waste	All contaminants remain on-site	Same as Alternative SC-1	No secondary wastes from fixation treatment process	Same as Alternative SC-3A
Implementability				
o Technical Feasibility				
- Ability to construct technology	No difficulty	Uses standard earthwork equipment	Standard equipment is commercially available	Same as Alternative SC-3A
- Reliability of technology	Depends upon public awareness and control of site access.	Synthetic liners could fail	Well developed and proven technology. Pilot-scale studies required to optimize treatment.	Same as Alternative SC-3A
- Ease of undertaking additional remedial action if necessary	No difficulty	Cap would have to be reconstructed	No difficulty	Same as Alternative SC-3A
- Monitoring considerations	Long-term monitoring required, monitoring analysis techniques are available.	Same as Alternative SC-1	No long-term monitoring required.	On-site landfill requires long-term monitoring.

TABLE 11 (Cont'd)

OPERABLE UNIT ONE (PLANT SITE SOURCE CONTROL)

SUMMARY OF EVALUATIONS AND COST INFORMATION FOR EACH ALTERNATIVE

ASSESSMENT FACTORS	ALTERNATIVE SC-3C	ALTERNATIVE SC-4A	ALTERNATIVE SC-4B	ALTERNATIVE SC-4C
Reduction of Toxicity, Mobility or Volume				
- Treatment process and remedy	Reduction in contaminant mobility by fixation process. No reduction in toxicity or volume of contaminants. Fixated soils remain on-site in unlined redeposition areas.	Significant reductions in toxicity, mobility and volume of soils by extraction treatment process	Same as Alternative SC-4A	Same as Alternative SC-4A except treated materials ultimately disposed of in unlined redeposition areas.
- Amount of hazardous materials remaining	All hazardous materials bound within a fixated matrix. of off-site	All hazardous materials consolidated and disposed	Same as Alternative SC-4A	Same as Alternative SC-4A
- Irreversibility of the treatment	Treatment is essentially irreversible.	Same as Alternative SC-3C	Same as Alternative SC-3C	Same as Alternative SC-3C
- Type and quantity of residual waste	No secondary wastes from fixation treatment process. by extraction treatment process.	Substantial quantities of hazardous sludges generated	Same as Alternative SC-4A	Same as Alternative SC-4A
Implementability				
o Technical Feasibility				
- Ability to construct technology	Standard equipment is commercially available	Same as Alternative SC-3C	Same as Alternative SC-3C	Same as Alternative SC-3C
- Reliability of technology	Well developed and proven technology. Pilot-scale studies required to optimize treatment. Redeposition not as reliable as a landfill liner/cap scenario.	Well developed and proven technology.	Same as Alternative SC-4A	Same as Alternative SC-3C
- Ease of undertaking additional remedial action if necessary	No difficulty	No difficulty	No difficulty	No difficulty
- Monitoring considerations	Long-term monitoring required. Monitoring analysis techniques available.	No long-term monitoring required.	Same as Alternative SC-3C	Same as Alternative SC-3C

TABLE 11 (Cont'd)

OPERABLE UNIT ONE (PLANT SITE SOURCE CONTROL)

SUMMARY OF EVALUATIONS AND COST INFORMATION FOR EACH ALTERNATIVE

ASSESSMENT FACTORS	ALTERNATIVE SC-5	ALTERNATIVE SC-6
Reduction in Toxicity, Mobility or Volume		
- Treatment process and remedy	Reduction in toxicity and volume of contaminants. Mobility is the arsenic removal mechanism.	Reduction in mobility of contaminants due to fixation process. No reduction in volume or toxicity of contaminants.
- Amount of hazardous material remaining	All hazardous materials consolidated and disposed of off-site	All hazardous materials bound within a fixated matrix
- Irreversibility of the treatment	Treatment is essentially irreversible.	Same as Alternative SC-5
- Type and quantity of residual waste	Significant quantities of hazardous treatment sludges generated from groundwater treatment system	No secondary wastes generated
Implementability		
o Technical Feasibility		
- Ability to construct	Standard equipment commercially available.	Same as Alternative SC-5.
- Reliability of technology	Bench-scale studies in conjunction with groundwater modeling required to optimize treatment. Groundwater treatment technologies are proven and highly reliable.	Well developed and proven technology. Pilot-scale studies required to optimize treatment.
- Ease of undertaking additional remediation if necessary	No difficulty	Additional remediation would be difficult since all of presently contaminated areas would be solidified in place.
- Monitoring considerations	Long-term monitoring is required Techniques for analysis are available.	Same as Alternative SC-5

TABLE 11 (Cont'd)

OPERABLE UNIT ONE (PLANT SITE SOURCE CONTROL)

SUMMARY OF EVALUATIONS AND COST INFORMATION FOR EACH ALTERNATIVE

ASSESSMENT FACTORS	ALTERNATIVE SC-1	ALTERNATIVE SC-2	ALTERNATIVE SC-3A	ALTERNATIVE SC-3B
o Administrative Feasibility				
- Ability to obtain approvals	Permits not required	Hauling and landfilling permits for RCRA impoundment material (applicable to all remedial action alternatives)	Delisting approval required from NJDEP	Delisting approval required from EPA Region II. As the site falls under CERCLA, permits for the landfill are not required.
- Coordination with other agencies	Coordination required	Coordination required	Coordination required	Intensive coordination required for on-site landfill facility.
Availability of Services & Materials				
- Treatment capacity & disposal services	Not required	RCRA facilities available for RCRA impoundment material.	All components adequately available. Off-site landfill requires administrative acquisition.	Same as Alternative SC-3A except on-site landfill provides higher availability for disposal.
- Necessary equipment & specialists	Not required	Not required	Standard equipment and operations. Specialists not required.	Same as Alternative SC-3A
- Prospective technology	Not required	Not required	Prospective technologies are available and have been proven in bench-scale tests. Pilot studies needed to optimize process.	Same as Alternative SC-3A

TABLE 11 (Cont'd)

OPERABLE UNIT ONE (PLANT SITE SOURCE CONTROL)

SUMMARY OF EVALUATIONS AND COST INFORMATION FOR EACH ALTERNATIVE

ASSESSMENT FACTORS	ALTERNATIVE SC-3C	ALTERNATIVE SC-4A	ALTERNATIVE SC-4B	ALTERNATIVE SC-4C
o Administrative Feasibility				
- Ability to obtain approvals	Delisting required from EPA Region II. Approval for on-site redeposition may be difficult to obtain. ID 27 waste classification would prevent implementation of alternative.	Delisting required from NJDEP	Delisting approval required from EPA Region II. As the site falls under CERCLA, permits for the landfill are not required.	Same as Alternative 3C
- Coordination with other agencies	Coordination required for approval of on-site redeposition	Coordination required for identification of off-site nonhazardous and hazardous landfills.	Intensive coordination required for on-site landfill facility and identification of off-site hazardous landfill	Coordination required for approval of on-site redeposition and identification of hazardous landfill.
Availability of Services & Materials				
- Treatment capacity & disposal services	Treatment capacity, storage capacity and disposal capacity are all adequately available	Treatment and storage capacity are adequately available. Off-site landfill requires administrative acquisition.	Same as Alternative SC-4A except on-site landfill provides higher availability for disposal.	Same as Alternative SC-3C
- Necessary equipment & specialists	Standard equipment and operations. Specialists not required.	Same as Alternative SC-3C	Same as Alternative SC-3C	Same as Alternative SC-3C
- Prospective technologies	Prospective technologies are available and have been proven in bench-scale test. Pilot studies needed to optimize process.	Same as Alternative SC-3C	Same as Alternative SC-3C	Same as Alternative SC-3C

TABLE 11 (Cont'd)

OPERABLE UNIT ONE (PLANT SITE SOURCE CONTROL)

SUMMARY OF EVALUATIONS AND COST INFORMATION FOR EACH ALTERNATIVE

ASSESSMENT FACTORS	ALTERNATIVE SC-5	ALTERNATIVE SC-6
o **Administrative Feasibility**		
- Ability to obtain approvals	RCRA LDRs do not apply to in situ treatment methods, thus minimizing administrative approvals for this alternative	Same as Alternative SC-5
- Coordination with other agencies	Coordination required to identify an off-site hazardous landfill facility	Coordination required to limit future site use
Availability of Services & Materials		
- Treatment capacity & disposal services	The groundwater treatment system would handle the additional load of arsenic from the leach field.	In situ fixation systems available to treat large volumes of soil in place.
- Necessary equipment & specialists	Standard equipment, does not require specialists	Shallow soil mixing rig with chemical feed system is available. Requires specially trained equipment operators.
- Prospective technology	Prospective technology has been demonstrated in bench-scale test. Pilot studies would be required to optimize treatment.	Same as Alternative SC-5

TABLE 11 (Cont'd)

OPERABLE UNIT ONE (PLANT SITE SOURCE CONTROL)

SUMMARY OF EVALUATIONS AND COST INFORMATION FOR EACH ALTERNATIVE

ASSESSMENT FACTORS	ALTERNATIVE SC-1	ALTERNATIVE SC-2	ALTERNATIVE SC-3A	ALTERNATIVE SC-3B
Costs				
o Total Capital Cost	$ 483,419	$6,342,000	$45,818,000	$16,623,000
o Annual Operation and Maintenance cost	$ 37,000	$ 59,000	$18,796,000	$18,796,000 short-term $ 123,671 long-term
o Present Worth	$1,222,000	$7,232,000	$62,937,000	$35,466,000
Compliance with ARARs				
- Compliance with contaminant-specific ARARs	No contaminant-specific ARARs for arsenic-contaminated soil would be met New Jersey TBC for arsenic would not be met.	Same as Alternative SC-1	Soils treated to New Jersey Guidance TBC level for arsenic in soils	Same as Alternative SC-3A
- Appropriateness of waivers	Not applicable	Not applicable	Treatability variance may be required.	Same as Alternative SC-3A
- Compliance with action-specific ARARs	Not applicable	All action-specific ARARs will be met.	Same as Alternative SC-2	Same as Alternative SC-2
- Compliance with appropriate criteria, advisories, and guidances	Not in compliance with State and local criteria or Federal advisories	Will be in compliance with State and local criteria and federal advisories	Same as Alternative SC-2	Same as Alternative SC-2
Overall Protection of Human Health and the Environment	No protection of human health or the environment	Potential long-term threats to human health and the environment if capping system	Substantial and permanent protection of human health and the environment.	Same as Alternative SC-3A except fixated soils disposed in a controlled on-site landfill.
State Acceptance	No State comments received to date.	RCRA LDRs surface impoundments and modified capping have been added.	RCRA LDRs and concerns over disposal have been included.	Same as Alternative SC-3A
Community Acceptance	No public comments received to date.	Same as Alternative SC-1	Same as Alternative SC-1	Same as Alternative SC-1

TABLE 11 (Cont'd)

OPERABLE UNIT ONE (PLANT SITE SOURCE CONTROL)

SUMMARY OF EVALUATIONS AND COST INFORMATION FOR EACH ALTERNATIVE

ASSESSMENT FACTORS	ALTERNATIVE SC-3C	ALTERNATIVE SC-4A	ALTERNATIVE SC-4B	ALTERNATIVE SC-4C
Costs				
o Total Capital Cost	$ 9,199,019	$41,077,000	$20,227,000	$13,293,000
o Annual Operation and Maintenance Cost	$18,796,000 short-term $ 11,970 long-term	$ 1,927,000	$ 1,927,000 short-term $ 105,000 long-term	$ 1,927,000 short-term $ 11,970 long-term
o Present Worth	$26,484,000	$44,560,000	$25,102,000	$16,934,000
Compliance with ARARs				
- Compliance with contaminant-specific ARARs	Soils treated to New Jersey Guidance TBC Level for arsenic in soils	Same as Alternative SC-3C	Same as Alternative SC-3C	Same as Alternative SC-3C
- Appropriateness of waivers	ID 27 waste classification must be waived. Treatability variance may be required.	Treatability variance may be required.	Same as Alternative SC-4	Same as Alternative SC-3C
- Compliance with action-specific ARARs	All action-specific ARARs will be met.	Same as Alternative SC-3C	Same as Alternative SC-3C	Same as Alternative SC-3C
- Compliance with appropriate criteria advisories, and guidances	Will be in compliance with State and local criteria and Federal advisories.	Same as Alternative SC-3C	Same as Alternative SC-3C	Same as Alternative SC-3C
Overall Protection of Human Health and the Environment	Substantial and permanent protection of human health and the environment. Contaminants remain on-site in a fixated matrix without the protection of a liner or a cap.	Contaminants removed by extraction, rendering the soils nonhazardous. Exposure pathways eliminated. Sludges managed at off-site facility.	Same as Alternative SC-4A excepted treated soils are disposed in an on-site landfill.	Same as Alternative SC-4A except redeposition areas are not as controlled as a landfill
State Acceptance	RCRA LDRs and concerns over disposal options have been addressed.	Same as Alternative SC-3C	Same as Alternative SC-3C	Same as Alternative SC-3C
Community Acceptance	No public comments received to date.	Same as Alternative SC-3C	Same as Alternative SC-3C	Same as Alternative SC-3C

TABLE 11 (Cont'd)

OPERABLE UNIT ONE (PLANT SITE SOURCE CONTROL)

SUMMARY OF EVALUATIONS AND COST INFORMATION FOR EACH ALTERNATIVE

ASSESSMENT FACTORS	ALTERNATIVE SC-5	ALTERNATIVE SC-6
Costs		
o Total Capital Cost	$4,549,000	$ 7,619,000
o Annual Operation and Maintenance cost	$ 68,500 short-term $ 11,970 long-term	$18,761,000 short-term $ 11,970 long-term
o Present Worth	$5,159,000	$24,872,000
Compliance with ARARs		
- Compliance with contaminant-specific ARARs	Soils treated to New Jersey Guidance TBC level for arsenic in soils.	Same as Alternative SC-5
- Appropriateness of waivers	RCRA LDRs and the associated waivers do not apply to in situ treatment.	Same as Alternative SC-5
- Compliance with action-specific ARARs	All action-specific ARARs will be met.	Same as Alternative SC-5
- Compliance with appropriate criteria advisories, and guidances	Will be in compliance with State and local criteria and Federal advisories.	Same as Alternative SC-5
Overall Protection of Human Health and the Environment	Potential long-term threats if alternative failed to flush out the arsenic contaminants or if the groundwater pumping and treatment system failed.	Potential long-term threats if alternative failed.
State Acceptance	Impacts of soil flushing addressed under the management of migration alternative. Coordination with impoundment closure and additional testing have been addressed.	No State comments received to date.
Community Acceptance	No public comments received to date.	Same as Alternative SC-5

TABLE 12

OPERABLE UNIT TWO (PLANT SITE MANAGEMENT OF MIGRATION)

SUMMARY OF EVALUATIONS AND COST INFORMATION FOR EACH TREATMENT OPTION

ASSESSMENT FACTORS	TREATMENT OPTION T-1	TREATMENT OPTION T-2	TREATMENT OPTION T-3
Key Components	Chemical Precipitation/Air Stripping/Vapor Phase Activated Carbon Adsorption/Liquid Phase Activated Alumina Adsorption	Chemical Oxidation/Chemical Precipitation/Ion Exchange/ Liquid Phase Activated Carbon Adsorption	UV-H_2O_2 Oxidation/Chemical Precipitation
Short-Term Effectiveness			
- Protection of community during remedial actions	Potential for inhalation of fugitive dust during construction of the treatment facilities	Same as Treatment Option T-1	Same as Treatment Option T-1
- Protection of workers during remediation	Personnel protection equipment required against dermal contact and inhalation of fugitive dust during construction of treatment facilities	Same as Treatment Option T-1	Same as Treatment Option T-1
- Environmental Impacts	Potential environmental impact from change of site use	Same as Treatment Option T-1	Same as Treatment Option T-1
- Time until remediation	N/A	N/A	N/A
Long-Term Effectiveness			
- Magnitude of Residual Risk	Treated effluent is expected to meet delisting requirements. Any residual waste would be disposed of according to RCRA standards.	Same as Treatment Option T-1	Same as Treatment Option T-1
- Adequacy of Controls	Proven technologies. Long-term monitoring program required to ensure effectiveness of treatment system.	Same as Treatment Option T-1	Same as Treatment Option T-1
- Reliability of Controls	Technologies are very reliable treatment methods	Same as Treatment Option T-1	Same as Treatment Option T-1
Reduction of Toxicity, Mobility or Volume			
- Treatment Process and Remedy	Reduction in toxicity and volume of groundwater contaminants	Same as Treatment Option T-1	Same as Treatment Option T-1
- Amount of Hazardous Materials Remaining	N/A	N/A	N/A

TABLE 12 (Cont'd)

OPERABLE UNIT TWO (PLANT SITE MANAGEMENT OF MIGRATION)

SUMMARY OF EVALUATIONS AND COST INFORMATION FOR EACH TREATMENT OPTION

ASSESSMENT FACTORS	TREATMENT OPTION T-1	TREATMENT OPTION T-2	TREATMENT OPTION T-3
- Irreversibility of Treatment	Treatment is irreversible	Same as Treatment Option T-1	Same as Treatment Option T-1
- Type of Quantity of Residual Waste	Arsenic sludge generated from clarification would require off-site RCRA treatment and disposal	Same as Treatment Option T-1 Ion exchange generates highly contaminated resins requiring regeneration. Spent carbon may be disposed or regenerated.	Same as Treatment Option T-1
Implementability			
o Technical Feasibility			
- Ability to Construct	Standard equipment commercially available	Same as Treatment Option T-1	Relatively few experienced vendors who could supply the equipment and the trained personnel to operate and maintain the system
- Reliability of Technology	Well developed and proven technology	Same as Treatment Option T-1	Innovative technology
- Ease of Undertaking Additional Remedial Action If Necessary	No difficulty	Same as Treatment Option T-1	Same as Treatment Option T-1
- Monitoring Considerations	Monitoring of treated effluent required to ensure effectiveness of technology	Same as Treatment Option T-1	Same as Treatment Option T-1
o Administrative Feasibility			
- Ability to Obtain Approvals	Delisting approval required from USEPA Region II Regional Administrator	Same as Treatment Option T-1	Same as Treatment Option T-1
- Coordination with Other Agencies	Coordination required	Same as Treatment Option T-1	Same as Treatment Option T-1
Availability of Services and Materials			
- Availability of Treatment Capacity and Disposal	Treatment capacity and storage capacity are adequately available	Same as Treatment Option T-1	Same as Treatment Option T-1

TABLE 12 (Cont'd)

OPERABLE UNIT TWO (PLANT SITE MANAGEMENT OF MIGRATION)

SUMMARY OF EVALUATIONS AND COST INFORMATION FOR EACH TREATMENT OPTION

ASSESSMENT FACTORS	TREATMENT OPTION T-1	TREATMENT OPTION T-2	TREATMENT OPTION T-3
- Availability of Necessary Equipment and Specialists	Standard equipment and operations. No specialists required	Same as Treatment Option T-1	Specialized equipment and operators required. Very few experienced vendors and operators
- Availability of Prospective Technologies	Prospective technologies are available. Technologies are proven in bench-scale tests. Pilot studies required to optimize process	Same as Treatment Option T-1	Few experienced vendors. Technologies need to be proven in bench-scale tests. Pilot studies required to optimize process.
Costs			
- Total Capital Cost			
o Considering Downgradient Capture Pumping	$1,809,000	$1,460,000	$1,097,000
o Considering Downgradient Capture and Source Area Pumping	$2,871,000	$2,027,000	$1,521,000
o Considering Site Pumping	$4,230,000	$2,515,000	$1,948,000
- Baseline Annual Operation and Maintenance Cost	N/A	N/A	N/A
- Present Worth	N/A	N/A	N/A
Compliance With ARARs			
- Compliance with Contaminant-Specific ARARs	Will meet MCL for arsenic, cadmium, and TCE	Same as Treatment Option T-1	Same as Treatment Option T-1
- Appropriateness of waivers	N/A	N/A	N/A
- Compliance with Action-Specific ARARs	All action-specific ARARs will be met	Same as Treatment Option T-1	Same as Treatment Option T-1
- Compliance with Appropriate Criteria, Advisories and Guidance	Will be in compliance with State and local criteria and federal advisories	Same as Treatment Option T-1	Same as Treatment Option T-1

TABLE 12 (Cont'd)

OPERABLE UNIT TWO (PLANT SITE MANAGEMENT OF MIGRATION)

SUMMARY OF EVALUATIONS AND COST INFORMATION FOR EACH TREATMENT OPTION

ASSESSMENT FACTORS	TREATMENT OPTION T-1	TREATMENT OPTION T-2	TREATMENT OPTION T-3
Overall Protection of Human Health and the Environment	Extracted groundwater will be treated to levels below MCLs of the contaminants of concern thus adequately protecting human health and the environment	Same as Treatment Option T-1	Same as Treatment Option T-1
State Acceptance	No specific State comments received regarding the groundwater treatment unit operations	Same as Treatment Option T-1	Same as Treatment Option T-1
Community Acceptance	No public comments have been received to date	Same as Treatment Option T-1	Same as Treatment Option T-1

TABLE 13

OPERABLE UNIT TWO (PLANT SITE MANAGEMENT OF MIGRATION)

SUMMARY OF EVALUATIONS AND COST INFORMATION FOR EACH ALTERNATIVE

ASSESSMENT FACTORS	ALTERNATIVE MOM-1	ALTERNATIVE MOM-2B	ALTERNATIVE MOM-3A	ALTERNATIVE MOM-3B	ALTERNATIVE MOM-4A
Key Components	No Action: Natural attenuation, long-term monitoring, restricted use of the groundwater, public information meetings, five year reviews	Downgradient Capture/Treatment/ Reinjection	Downgradient Capture and Source Area Pumping/ Treatment/Discharge to the Maurice River	Downgradient Capture and Source Area Pumping/ Treatment/Reinjection	Site Pumping/Treatment/ Reinjection/Discharge to the Maurice River
Short-Term Effectiveness					
- Protection of community during remedial actions	No short-term risks to communities	Minimal risk to community	Same as Alternative MOM-2B	Some as Alternative MOM-2B	Same as Alternative MOM-2B
- Protection of workers during remediation	Personnel protection equipment required against inhalation and dermal contact during sign posting, sample collection, inspection	Minimal risk to workers. Personnel protection equipment required against direct contact with wastes and inhalation of fugitive dust	Same as Alternative MOM-2B	Same as Alternative MOM-2B	Same as Alternative MOM-2B
- Environmental Impacts	No environmental impacts	Downgradient capture would almost immediately minimize the migration of contaminated groundwater to the Blackwater Branch. Environmental impact from change of site use	Downgradient capture would almost immediately minimize the migration of contaminated groundwater to the Blackwater Branch. Greater environmental impact from change of site use due to larger capacity of treatment system	Same as Alternative MOM-3A	Same as Alternative MOM-3A
- Time Until Remediation	Many years (probably decades)	Estimated to require 75 years to achieve target cleanup objective	Estimated to require 30 years to achieve target cleanup objective	Estimated to require 25 years to achieve target cleanup objective	Estimated to require at most 13 years to achieve target cleanup objective

TABLE 13 (Cont'd)

OPERABLE UNIT TWO (PLANT SITE MANAGEMENT OF MIGRATION)

SUMMARY OF EVALUATIONS AND COST INFORMATION FOR EACH ALTERNATIVE

ASSESSMENT FACTORS	ALTERNATIVE MOM-1	ALTERNATIVE MOM-2B	ALTERNATIVE MOM-3A	ALTERNATIVE MOM-3B	ALTERNATIVE MOM-4A
Long-Term Effectiveness					
- Magnitude of Residual Risks	Long term evaluation required for natural degradation & transport reduction	Extracted groundwater would be treated to below MCLs. Aquifer would be remediated to 0.35 mg/l arsenic. This would protect the in-stream standard of the Blackwater Branch.	Same as Alternative MOM-2B	Same as Alternative MOM-2B	Same as Alternative MOM-2B
- Adequacy of Controls	Adequacy of control to prevent human ingestion dependent on success of the well restriction area	Proven technologies. Downgradient capture would minimize contaminant migration to the Blackwater Branch. Establishment of well restriction area would minimize possibility of human ingestion/ use of groundwater. Downgradient capture could induce infiltration from the Branch.	Same as Alternative MOM-2B. Source area pumping would extract contaminants directly from the plume. High pumping rate could depress the natural water level of the Blackwater Branch or dewater the Branch. Treated effluent could be diverted to the Branch to minimize this impact.	Proven technologies. Downgradient capture would minimize contaminant migration to the Blackwater Branch. Establishment of well restriction area would minimize possibility of human ingestion/use of groundwater. High pumping rate could depress the natural water level of the Blackwater Branch or dewater the Branch. If this is determined, treated effluent could be diverted to the Branch.	Same as Alternative MOM-3B. Site pumping would extract contaminants directly from the plume.
- Reliability of Controls	Migration of contaminants from site to Blackwater Branch, Maurice River and Union Lake would continue	Extraction of groundwater via pumping and reinjection of treated effluent are reliable technologies. Long-term monitoring would be required to ensure the effectiveness of this alternative.	Extraction of groundwater via pumping and discharge of treated effluent to a surface water body is a reliable technology. Long-term monitoring would be required to ensure the effectiveness of this alternative.	Proven and reliable technologies. Long-term monitoring would be required to ensure the effectiveness of this alternative	Same as Alternative MOM-3B

TABLE 13 (Cont'd)

OPERABLE UNIT TWO (PLANT SITE MANAGEMENT OF MIGRATION)

SUMMARY OF EVALUATIONS AND COST INFORMATION FOR EACH ALTERNATIVE

ASSESSMENT FACTORS	ALTERNATIVE MOM-1	ALTERNATIVE MOM-2B	ALTERNATIVE MOM-3A	ALTERNATIVE MOM-3B	ALTERNATIVE MOM-4A
Reduction of Toxicity, Mobility or Volume					
- Treatment Process and Remedy	No reduction of toxicity, mobility or volume	Reduction of volume and off-site mobility of aquifer contaminants. Reinjection actually increases on-site mobility to facilitate collection of the plume. Any of the treatment process options would reduce the toxicity	Reduction of off-site mobility and volume of aquifer contaminants. Any of the treatment process options would reduce the toxicity	Same as Alternative MOM-3B	Same as Alternative MOM-3A
- Amount of Hazardous Materials Remaining	No material removed or treated	Remediation will continue until the aquifer arsenic concentration is 0.35 mg/l. Natural attenuation required to flush aquifer to the arsenic MCL (0.05 mg/l).	Same as Alternative MOM-2B	Same as Alternative MOM-2B	Same as Alternative MOM-2B
- Irreversibility of Treatment	N/A	N/A	N/A	N/A	N/A
- Type and Quantity of Residual Waste	N/A	N/A	N/A	N/A	N/A
Implementability					
o **Technical Feasibility**					
- Ability to Construct Technology	No difficulty	Standard equipment commercially available	Same as Alternative MOM-2B	Same as Alternative MOM-2B	Same as Alternative MOM-2B. Increase in units may complicate operations
- Reliability of Technology	N/A	Well developed and proven technology. More sophisticated groundwater modeling required to refine K_d, pumping rates and pumping duration	Same as Alternative MOM-2B	Same as Alternative MOM-2B	Same as Alternative MOM-2B

TABLE 13 (Cont'd)

OPERABLE UNIT TWO (PLANT SITE MANAGEMENT OF MIGRATION)

SUMMARY OF EVALUATIONS AND COST INFORMATION FOR EACH ALTERNATIVE

ASSESSMENT FACTORS	ALTERNATIVE MOM-1	ALTERNATIVE MOM-2B	ALTERNATIVE MOM-3A	ALTERNATIVE MOM-3B	ALTERNATIVE MOM-4A
- Ease of Undertaking Additional Remedial Action if Necessary	No difficulty	No difficulty. No additional remedial action is anticipated	Same as Alternative MOM-2B	Same as Alternative MOM-2B	Same as Alternative MOM-2B
- Monitoring Considerations	Long-term monitoring program is required	Long-term monitoring program required to ensure the effectiveness of the alternative	Same as Alternative MOM-2B	Same as Alternative MOM-2B	Same as Alternative MOM-2B
o Administrative Feasibility					
- Ability to Obtain Approvals	Permitting not required	Delisting approval required from the Regional Administrator of USEPA Region II. Permission required to access properties to install wells and the pipeline located off the ViChem Site	Same as Alternative MOM-2B. As this is a CERCLA site, permits for a surface water discharge are not required. However the treated effluent is expected to comply with applicable discharge limitations.	Same as Alternative MOM-2B	Same as Alternative MOM-3A.
- Coordination with Other Agencies	Coordination is required	Intensive coordination required for delisting of treated effluent	Same as Alternative MOM-2B	Same as Alternative MOM-2B	Same as Alternative MOM-2B
Availability of Services & Materials					
- Availability of Treatment Capacity & Disposal Services	Not required	Treatment capacity and disposal services are readily available	Same as Alternative MOM-2B	Same as Alternative MOM-2B	Same as Alternative MOM-2B
- Availability of Necessary Equipment & Specialists	Not required	Standard equipment and operations. No specialists required	Same as Alternative MOM-2B	Same as Alternative MOM-2B	Same as Alternative MOM-2B

TABLE 13 (Cont'd)

OPERABLE UNIT TWO (PLANT SITE MANAGEMENT OF MIGRATION)

SUMMARY OF EVALUATIONS AND COST INFORMATION FOR EACH ALTERNATIVE

ASSESSMENT FACTORS	ALTERNATIVE MOM-1	ALTERNATIVE MOM-2B	ALTERNATIVE MOM-3A	ALTERNATIVE MOM-3B	ALTERNATIVE MOM-4A
- Availability of Prospective Technologies	Not required	Prospective technogies are available. Computer modeling demonstrated the feasibility of the pumping technologies. More sophisticated modeling is required to optimize system. Additional studies are also required to refine K_d.	Same as Alternative MOM-2B	Same as Alternative MOM-2B	Same as Alternative MOM-2B
Costs					
- Total Capital Cost	$ 3,620	N/A	N/A	N/A	N/A
- Annual Operation and Maintenance Cost	$ 14,010	N/A	N/A	N/A	N/A
- Present Worth	$288,532	N/A	N/A	N/A	N/A
o Treatment Option T-1					
- Total Capital Cost	N/A	$ 3,363,000	$ 6,037,000	$ 5,014,000	$ 8,694,000
- Annual Operation and Maintenance Cost	N/A	$ 3,369,000	$ 5,599,000	$ 5,513,000	$ 6,128,000
- Present Worth	N/A	$65,944,000	$65,540,000	$60,152,000	$50,350,000
o Treatment Option T-2					
- Total Capital Cost	N/A	$ 2,919,000	$ 4,965,000	$ 3,942,000	$ 6,991,000
- Annual Operation and Maintenance Cost	N/A	$ 2,263,000	$ 3,618,000	$ 3,532,000	$ 5,155,000
- Present Worth	N/A	$44,981,000	$44,181,000	$39,936,000	$34,147,000

TABLE 13 (Cont'd)

OPERABLE UNIT TWO (PLANT SITE MANAGEMENT OF MIGRATION)

SUMMARY OF EVALUATIONS AND COST INFORMATION FOR EACH ALTERNATIVE

ASSESSMENT FACTORS	ALTERNATIVE MOM-1	ALTERNATIVE MOM-2B	ALTERNATIVE MOM-3A	ALTERNATIVE MOM-3B	ALTERNATIVE MOM-4A
o Treatment Option T-3					
- Total Capital Cost	N/A	$ 2,459,000	$ 4,323,000	$ 3,300,000	$ 5,796,000
- Annual Operation and Maintenance Cost	N/A	$ 3,065,000	$ 5,052,000	$ 4,966,000	$ 7,291,000
- Present Worth	N/A	$59,407,000	$58,226,000	$53,154,000	$43,373,000
Compliance with ARARs					
- Compliance with Contaminant-Specific ARARs	No contaminant-specific ARARs will be achieved.	The aquifer will be remediated to an arsenic concentration of 0.35 mg/l. This will not violate the instream standard of 0.05 mg/l arsenic in the Blackwater Branch.	Same as Alternative MOM-2B	Same as Alternative MOM-2B	Same as Alternative MOM-2B
- Appropriateness of Waivers	N/A	Per NJDEP guidance the establishment of an ACL is relevant and appropriate for the ViChem Site.	Same as Alternative MOM-2B	Same as Alternative MOM-2B	Same as Alternative MOM-2B
- Compliance with Action-Specific ARARs	Not applicable	Will comply with all action-specific ARARs	Same as Alternative MOM-2B	Same as Alternative MOM-2B	Same as Alternative MOM-3B
- Compliance with Appropriate Criteria, Advisories, and Guidance	Not in compliance with state and local criteria and federal advisories	Will be in compliance with State and local criteria and federal advisories	Same as Alternative MOM-2B	Same as Alternative MOM-2B	Same as Alternative MOM-3B

TABLE 13 (Cont'd)

OPERABLE UNIT TWO (PLANT SITE MANAGEMENT OF MIGRATION)

SUMMARY OF EVALUATIONS AND COST INFORMATION FOR EACH ALTERNATIVE

ASSESSMENT FACTORS	ALTERNATIVE MOM-1	ALTERNATIVE MOM-2B	ALTERNATIVE MOM-3A	ALTERNATIVE MOM-3B	ALTERNATIVE MOM-4A
Overall Protection of Human Health and the Environment	Risk of ingestion of and direct contact with the contaminated groundwater controlled but not eliminated. Migration of groundwater to the Maurice River and Union Lake would continue.	Human health would be adequately protected through the implementation of this pumping and treatment alternative and through the establishment of a well restriction area. This restriction would apply until natural flushing mechanisms reduced the arsenic concentration to the MCL. Contaminant migration to the Maurice River and Union Lake would be minimized.	Same as Alternative MOM-2B	Same as Alternative MOM-2B	Same as Alternative MOM-2B
State Acceptance	No State comments received to date	This alternative was developed in response to the State's comments regarding alternate means of disposal of the treated effluent.	This alternative was developed in response to the State's comments concerning the significant environmental impacts associated with the disposal of the treated effluent in the Blackwater Branch.	Same as Alternative MOM-2B	Same as Alternative MOM-3A
Community Acceptance	No public comments received to date	Same as Alternative MOM-1	Same as Alternative MOM-1	Same as Alternative MOM-1	Same as Alternative MOM-1

TABLE 14

OPERABLE UNIT THREE (RIVER AREAS SEDIMENTS)

SUMMARY OF EVALUATIONS AND COST INFORMATION FOR EACH ALTERNATIVE

Assessment Factors	Alternative 1 - No Action	Alternative 2A-Dredging/ Excavation/Thickening/ Fixation/Off-Site Nonhazardous Landfill	Alternative 2B-Dredging/ Excavation/Thickening/ Fixation/On-Site Nonhazardous Landfill
Short Term Effectiveness			
-Protection of community during remedial actions	No short-term threats to communities.	Potential for direct contact of spilled waste and inhalation of fugitive dust.	Same as Alternative 2A.
-Protection of workers during remedial actions	Personnel protection equipment required against dermal contact and inhalation during sign posting, sample collection, inspection.	Minimal risk to workers. Personnel protection equipment required against direct contact with wastes and inhalation of fugitive dust.	Same as Alternative 2A.
-Environmental Impacts	No significant adverse environmental impacts from site activities.	Increased traffic, noise, and air pollution. Sediment resuspension minimized by increasing water intake of dredge and use of silt curtains.	Minimal increase in traffic, noise and air pollution. Sediment resuspension minimized by increasing water intake of dredge and use of silt curtains.
		Excavation of exposed sediments would pose minimal impacts.	Same as Alternative 2A.
-Time until remediation	Some years.	Estimated to be 3 years from start of construction to completion of remediation work.	Same as Alternative 2A.

TABLE 14 (Cont'd)

OPERABLE UNIT THREE (RIVER AREAS SEDIMENTS)

SUMMARY OF EVALUATIONS AND COST INFORMATION FOR EACH ALTERNATIVE

Assessment Factors	Alternative 3A-Dredging/Excavation/Extraction/Sediments to Off-Site Nonhazardous Landfill/Off-Site Hazardous Sludge Disposal	Alternative 3B-Dredging/Excavation/Extraction/Sediments to On-Site Nonhazardous Landfill/Off-site Hazardous Sludge Disposal	Alternative 3C-Dredging/Excavation/Extraction/Floodplain Deposition of Exposed Sediments/Plant Site Deposition of River Sediments/Off-Site Hazardous Sludge Disposal
Short-Term Effectiveness			
-Protection of community during remedial actions	Potential for direct contact of spilled waste and inhalation of fugitive dust.	Same as Alternative 3A.	Same as Alternative 3A.
-Protection of workers during remedial actions	Minimal risk to workers. Personnel protection equipment required against direct contact with wastes and inhalation of fugitive dust.	Same as Alternative 3A.	Same as Alternative 3A.
-Environmental Impacts	Increased traffic, noise, and air pollution sediment resuspension minimized by increasing water intake of dredge and using silt curtains.	Minimal increase in traffic noise and air pollution, sediment resuspension minimized by increasing water intake of dredge and using silt curtains..	Same as Alternative 3B.
	Excavation of exposed sedimentswould pose minimal impacts.	Same as Alternative 3A.	
-Time until remediation	Estimated to be 3 years from start of construction to completion of remediation work.	Same as Alternative 3A.	Same as Alternative 3A.

TABLE 14 (Cont'd)

OPERABLE UNIT THREE (RIVER AREAS SEDIMENTS)

SUMMARY OF EVALUATIONS AND COST INFORMATION FOR EACH ALTERNATIVE

Assessment Factors	Alternative 1	Alternative 2A	Alternative 2B
Long-Term Effectiveness			
-Magnitude of Residual Risks	Existing impacts on the environment would persist. However, natural degradation and transport mechanisms could significantly reduce the volume of sediments in the river.	Sediments identified as a public health risk would be removed and treated. Redistribution of contaminated sediments could result in a public health risk. Treated sediments would be delisted as nonhazardous waste, supernatant water treated to NJPDES standards.	Same as Alternative 2A
-Adequacy of Control	Depends on success in preventing access to the site.	Proven technologies. Long-term monitoring program required for remaining sediment.	Same as Alternative 2A Long-term maintenance required for on-site landfill facility.
-Reliability of Controls	Migration of contaminants from sediments to water could occur.	If significant redistribution of sediments, additional remedial actions may be required.	Same as Alternative 2A. Minimal potential for failure of on-site landfill facility.
Reduction of Toxicity, Mobility or Volume			
-Treatment Process and Remedy	No reduction of toxicity, mobility or volume.	Reduction in mobility of treated sediment and slight reduction in volume of on-site sediments. No reduction in toxicity.	Same as Alternative 2A.
-Amount of Hazardous Materials Remaining	No material removed or treated.	Sediments identified as a public health risk are removed and treated to be delisted. Remaining sediments are not considered to pose health risks by the sediment ingestion pathway.	Same as Alternative 2A.

TABLE 14 (Cont'd)

OPERABLE UNIT THREE (RIVER AREAS SEDIMENTS)

SUMMARY OF EVALUATIONS AND COST INFORMATION FOR EACH ALTERNATIVE

Assessment Factors	Alternative 3A	Alternative 3B	Alternative 3C
Long-Term Effectiveness			
-Magnitude of Residual Risks	Sediment identified as a public health risk would be removed and treated. Redistribution of contaminated sediments could result in a public health risk. Treated sediment delisted as nonhazardous waste. Water treated to NJPDES Standards.	Same as Alternative 3A.	Same as Alternative 3A. Treated materials considered to be clean fill after substantive delisting.
-Adequacy of Control	Proven Technology. Long-term monitoring program required for remaining sediments.	Same as Alternative 3A. Long-term maintenance required for on-site landfill facility.	Same as Alternative 3A. Long-term monitoring required to assess the effectiveness of the alternative.
-Reliability of Controls	If significant redistribution of sediments occur, additional remedial actions may be required.	Same as Alternative 3A. Minimal failure of on-site landfill facility.	Same as Alternative 3A. Minimal potential of leachate from delisted sediments deposited on floodplain and plant site.
Reduction in Toxicity, Mobility or Volume			
-Treatment Process and Remedy	Permanent reduction in toxicity of treated sediments. Reduction in volume and mobility of on-site contaminants.	Same as Alternative 3A.	Same as Alternative 3A. Deposition offers greater mobility of leachate than landfilling.
-Amount of Hazardous Material Remaining	Sediments identified as a public health risk are removed and treated to be delistable. Remaining sediments do not pose health risk by the sediment ingestion pathway. Significant quantity of arsenic-contaminated sludge generated from extraction process.	Same as Alternative 3A.	Same as Alternative 3A.

TABLE 14 (Cont'd)

OPERABLE UNIT THREE (RIVER AREAS SEDIMENTS)

SUMMARY OF EVALUATIONS AND COST INFORMATION FOR EACH ALTERNATIVE

Assessment Factors	Alternative 1	Alternative 2A	Alternative 2B
-Irreversibility of The Treatment	N/A	Treatment is essentially irreversible.	Same as Alternative 2A.
-Type and Quantity of Residual Waste	N/A	Treated waste expected to be delisted.	Treated waste expected to be delisted.
Implementability			
o Technical Feasibility			
- Ability to Construct Technology	No difficulty.	Standard equipment commercially available.	Same as Alternative 2A.
- Reliability of Technology	No technology.	Well developed and proven technology. Pilot-scale studies required to optimize treatment.	Same as Alternative 2A.
- Ease of Undertaking Additional Remedial Action If Necessary	No difficulty.	Additional future remedial actions may be required.	Same as Alternative 2A.
- Monitoring Considerations	Long-term monitoring required, monitoring analysis techniques available.	Long-term monitoring required.	Long-term monitoring for on-site landfill and remaining sediment required. Monitoring analysis techniques available.

TABLE 14 (Cont'd)

OPERABLE UNIT THREE (RIVER AREAS SEDIMENTS)

SUMMARY OF EVALUATIONS AND COST INFORMATION FOR EACH ALTERNATIVE

Assessment Factors	Alternative 3A	Alternative 3B	Alternative 3C
-Irreversibility of The Treatment	Treatment is irreversible.	Same as Alternative 3A.	Same as Alternative 3A.
-Type and Quantity of Residual Waste	Treated waste expected to be delisted. Arsenic sludge generated from extraction process highly contaminated.	Same as Alternative 3A.	Same as Alternative 3A.
Implementability			
o Technical Feasibility			
-Ability to Construct	Standard equipment commercially available.	Same as Alternative 3A.	Same as Alternative 3A.
-Reliability of Technology	Well developed and proven technology. Pilot-scale studies required to optimize treatment.	Same as Alternative 3A.	Same as Alternative 3A. Floodplain and plant site deposition not as reliable as a landfill liner/cap scenario.
-Ease of Undertaking Additional Remediation If Necessary	Additional future remedial actions may be required.	Same as Alternative 3A.	Same as Alternative 3A.
-Monitoring Considerations	Long-term monitoring required.	Same as Alternative 3A. Long-term monitoring for on-site landfill required. Monitoring analysis techniques available.	Same as Alternative 3A.

TABLE 14 (Cont'd)

OPERABLE UNIT THREE (RIVER AREAS SEDIMENTS)

SUMMARY OF EVALUATIONS AND COST INFORMATION FOR EACH ALTERNATIVE

Assessment Factors	Alternative 1	Alternative 2A	Alternative 2B
o Administrative Feasibility			
-Ability to obtain Approvals	Permits not required.	Delisting approval required from NJDEP.	Delisting approval required from EPA Region II. As the site is a CERCLA site, permits for landfill are not required.
-Coordination with Other Agencies	Coordination required.	Coordination required.	Intensive coordination required for on-site landfill facility.
-Availability of Services & Materials			
-Availability of Treatment Capacity & Disposal Services	Not required.	Treatment capacity and storage capacity are all adequately available. Off-site landfill requires administrative acquisition.	Same as Alternative 2A. On-site landfill provides higher availability for disposal.
-Availability of Necessary Equipment & Specialists	Not required.	Standard equipment and operations. No specialists required.	Same as Alternative 2A.
-Availability of Prospective Technologies	Not required.	Prospective technologies are available. Technologies are proven in bench-scale tests. Pilot studies would be required to optimize process.	Same as Alternative 2A.
Costs			
o Total Capital Cost	$ 44,500	$ 28,868,000	$10,973,000
o Annual Operation and Maintenance Cost	$ 49,500	$ 13,020 Long-term $ 17,670,000 Short-term	$ 80,000 Long-Term $17,670,000 Short-term
o Present Worth	$874,200	$ 60,402,000	$43,386,000

TABLE 14 (Cont'd)

OPERABLE UNIT THREE (RIVER AREAS SEDIMENTS)

SUMMARY OF EVALUATIONS AND COST INFORMATION FOR EACH ALTERNATIVE

Assessment Factors	Alternative 3A	Alternative 3B	Alternative 3C
o Administrative Feasibility			
-Ability to obtain Approvals	Delisting approval required from NJDEP.	Delisting approval required from EPA Region II. As the site is a CERCLA site, permits for landfill are not required.	Same as Alternative 3B. Approval for floodplain and plant site deposition may be difficult to obtain. ID 27 waste classification of treated material would prevent implementation of alternative.
-Coordination with Other Agencies	Coordination required for identification of off-site nonhazardous and hazardous landfills.	Intensive coordination required for on-site landfill facility and identification of off-site hazardous landfill.	Coordination required for approval of floodplain and plant site deposition and identification of hazardous landfill.
-Availability of Services & Materials			
-Availability of Treatment Capacity & Disposal Services	Treatment capacity and storage are all adequately available. Off-site landfill requires administrative acquisition.	Same as Alternative 3A. On-site landfill provides higher availability for disposal.	Treatment capacity, storage capacity and disposal capacity are all adequately available.
-Availability of Necessary Equipment & Specialists	Standard equipment and operations. No specialists required.	Same as Alternative 3A.	Same as Alternative 3A.
-Availability of Prospective Technologies	Prospective technologies are available. Technologies are proven in bench-scale studies. Pilot-scale studies required to optimize process.	Same as Alternative 3A.	Same as Alternative 3A.
Costs			
o Total Capital Cost	$21,530,000	$13,209,000	$11,083,000
o Annual Operation & Maintenance Cost	$ 13,020 Long-term $ 1,587,000 Short-term	$ 54,000 Long-term $ 1,587,000 Short-term	$ 13,020 Long-term $ 1,587,000 Short-term
o Present Worth	$24,583,000	$16,808,000	$14,136,000

TABLE 14 (Cont'd)

OPERABLE UNIT THREE (RIVER AREAS SEDIMENTS)

SUMMARY OF EVALUATIONS AND COST INFORMATION FOR EACH ALTERNATIVE

Assessment Factors	Alternative 1	Alternative 2A	Alternative 2B
Compliance with ARARs			
-Compliance with contaminant-specific ARARs	No contaminant-specific ARAR established for arsenic contaminated sediment. Will not meet health-based levels.	No contaminant-specific ARAR established for arsenic contaminated sediments. Will meet health-based levels.	Same as Alternative 2A.
-Appropriateness of waivers	Not applicable.	Treatability variance may be required.	Same as Alternative 2A.
-Compliance with action-specific ARARs	Not applicable.	All action-specific ARARs will be met.	Same as Alternative 2A.
-Compliance with appropriate criteria, advisories, and guidance	Not in compliance with state and local criteria and federal advisories.	Will be in compliance with State and local criteria and federal advisories.	Same as Alternative 2A.
Overall Protection of Human Health and the Environment	Risk of direct contact with contaminated sediment and water controlled but not eliminated. Contaminants remain on-site and their toxicity, mobility or volume unaltered.	Risk of sediment ingestion reduced. Contaminants removed and chemically fixated to reduce toxicity and eliminate mobility. Volume of fixated solids will increase. Cancer risk level for those sediments identified as a public health risk would be reduced to levels protective of human health.	Same as Alternative 2A.
State Acceptance	State comments indicated that the No Action Alternative would be protective of human health if restrictive measures were enacted.	General comments from the State include the need for additional sampling prior to the initiation of a remedial action. The State also identified need for an environmental assessment in the river areas to determine impacts of dredging.	Same as Alternative 2A.
Community Acceptance	No public comments have been received to date.	Community expressed that no-action would be the preferred alternative for submerged sediments in the river areas.	Same as Alternative 2A.

TABLE 14 (Cont'd)

OPERABLE UNIT THREE (RIVER AREAS SEDIMENTS)

SUMMARY OF EVALUATIONS AND COST INFORMATION FOR EACH ALTERNATIVE

Assessment Factors	Alternative 3A	Alternative 3B	Alternative 3C
Compliance with ARARs			
-Compliance with contaminant-specific ARARs	No contaminant-specific ARAR established for arsenic. Treated sediment will meet health-based levels.	Same as Alternative 3A.	Same as Alternative 3A.
-Appropriateness of waivers	Treatability variance may be required.	Same as Alternative 3A.	ID 27 waste classification must be waived. Treatability variance may be required.
-Compliance with action-specific ARARs	All action-specific ARARs will be met.	Same as Alternative 3A.	Same as Alternative 3A.
-Compliance with appropriate criteria, advisories, and guidance	Will be in compliance with state and local criteria and Federal advisories.	Same as Alternative 2A.	Same as Alternative 3A.
Overall Protection of Human Health and the Environment	Risk of sediment ingestion reduced. Contaminants removed and extracted and converted to nonhazardous form. Volume of contaminants unchanged. Cancer risk level for those sediments identified as a public health risk reduced to levels protective of human health.	Same as Alternative 3A.	Same as Alternative 3A.
State Acceptance	General comments received from the State include the need for additional sampling prior to the initiation of a remedial action. The State also identified need for an environmental assessment in the river areas to determine the impacts of dredging.	Same as Alternative 3A.	Same as Alternative 3A.
Community Acceptance	Community expressed that no action would be the preferred alternative for the submerged sediments in the river areas.	Sames as Alternative 3A.	Same as Alternative 3A.

TABLE 15

OPERABLE UNIT FOUR (UNION LAKE SEDIMENTS)

SUMMARY OF EVALUATIONS AND COST INFORMATION FOR EACH ALTERNATIVE

Assessment Factors	Alternative 1 - No Action	Alternative 2A-Removal/ Fixation/Off-Site Nonhazardous Landfill	Alternative 2B-Removal/ Fixation/On-Site Nonhazardous Landfill	Alternative 3A-Removal/ Extraction/Sediments to Off-Site Nonhazardous Landfill/Off-Site Hazardous Sludge Disposal
Short-Term Effectiveness				
-Protection of community during remedial actions	No short-term threats to communities.	Potential for direct contact of spilled waste and inhalation of fugitive dust.	Same as Alternative 2A	Same as Alternative 2A.
-Protection of workers during remediation	Personnel protection equipment required against dermal contact and inhalation during sign posting, sample collection, inspection.	Minimal risk to workers. Personnel protection equipment required against direct contact with wastes and inhalation of fugitive dust	Same as Alternative 2A	Same as Alternative 2A.
-Environmental Impacts	No significant adverse environmental impacts from site activities.	Increased traffic, noise, and air pollution.	Minimal increase in traffic, noise and air pollution.	Same as Alternative 2A.
		Hydraulic dredging may result in localized resuspension of sediments. Migration of suspended particulates could be controlled by increasing the water intake of the dredge and utilizing silt curtains.	Same as Alternative 2A.	Hydraulic dredging may result in localized resuspension of sediments. Migration of suspended particulates could be controlled by increasing the water intake of the dredge and utilizing silt curtains.
		Excavation of the exposed sediments would pose minimal impacts.	Same as Alternative 2A.	Same as Alternative 2A.
-Time until remediation	Some years.	Estimated to be 3 years from start of construction to completion of remediation work.	Same as Alternative 2A.	Same as Alternative 2A.

TABLE 15 (Cont'd)

OPERABLE UNIT FOUR (UNION LAKE SEDIMENTS)

SUMMARY OF EVALUATIONS AND COST INFORMATION FOR EACH ALTERNATIVE

Assessment Factors	Alternative 3B-Removal/ Extraction/Sediment to On-Site Nonhazardous Landfill/Off-Site Hazardous Sludge Disposal	Alternative 3C-Removal/ Extraction/Lake Deposition of Sediments/Off-Site Hazardous Sludge Disposal	Alternative 3D-Removal/Extraction/ Plant Site Deposition of Sediments/Off-Site Hazardous Sludge Disposal	Alternative 5-In Situ Sand Covering
Short-Term Effectiveness				
-Protection of community during remedial actions	Same as Alternative 3A.	Same as Alternative 3A.	Same as Alternative 3A.	Same as Alternative 3A.
-Protection of workers during remediation	Same as Alternative 3A.	Same as Alternative 3A.	Same as Alternative 3A.	Same as Alternative 3A.
-Environmental Impacts	Minimal increase in traffic noise and air pollution. Same as Alternative 3A.	Same as Alternative 3B. Temporary adverse impacts such as resuspension of sediments may occur as a result of dredging and/or redeposition of treated material. Migration of suspended particulates could be controlled by increasing the water intake of the dredge and utilizing silt curtains.	Same as Alternative 3A.	If remediation is conducted when the lake is at its full condition discharge of the sand covering could result in temporary adverse impacts such as resuspension of sediment.
	Same as Alternative 3A.	Same as Alternative 3A.	Same as Alternative 3A.	Covering lake bottom count affect biota.
-Time until remediation	Same as Alternative 3A.	Same as Alternative 3A.	Same as Alternative 3A.	Estimated to be 1 year from start of remediation to finish.

TABLE 15 (Cont'd)

OPERABLE UNIT FOUR (UNION LAKE SEDIMENTS)

SUMMARY OF EVALUATIONS AND COST INFORMATION FOR EACH ALTERNATIVE

Assessment Factors	Alternative 1	Alternative 2A	Alternative 2B	Alternative 3A
Long-Term Effectiveness				
-Magnitude of Residual Risks	Long-term evaluation required for natural degradation and transport reduction.	Sediments identified as a public health risk would be removed and treated. Redistribution of contaminated sediments could result in a public health risk. Treated sediments delistable as non hazardous waste. Supernatant water treated to NJPDES.	Same as Alternative 2A.	Sediment identified as a public health risk would be removed and treated. Redistribution of contaminated sediments could result in a public health risk. Treated sediments delistable as nonhazardous waste. Supernatant water treated to NJPDES.
-Adequacy of Control	Depends on success in preventing access to the site.	Proven technologies. Long term monitoring program required for remaining sediment.	Same as Alternative 2A. Long-term maintenance required for on-site landfill facility.	Proven Technology. Long-term monitoring program required for remaining sediments.
-Reliability of Controls	Migration of contaminants from sediments to water could occur.	Excavation of the exposed sediments when the lake is at drawdown would offer more control of operations than dredging.	Same as Alternative 2A.	Excavation of exposed sediments when the lake is at drawdown would offer more control of operations than dredging.
		If significant redistribution of sediments, additional remedial actions may be required.	Same as Alternative 2A. Minimal failure of on-site landfill facility.	If significant redistribution of sediments occurs, additional remedial actions may be required.
Reduction of Toxicity, Mobility or Volume				
-Treatment Process and Remedy	No reduction of toxicity, mobility or volume.	Reduction in mobility of treated sediment and slight reduction in volume of on-site sediments. Increase in volume of treated sediments. No reduction in toxicity.	Same as Alternative 2A.	Permanent reduction in toxicity of treated sediments. Slight reduction in volume and mobility of on-site contaminants.
-Amount of Hazardous Materials Remaining	No material removed or treated.	Sediments identified as a public health risk are removed and treated to be delistable. Remaining sediments are not considered accessible for sediment ingestion pathway.	Same as Alternative 2A.	Sediments identified as a public health risk are removed and treated to be delistable. Remaining sediments are not considered accessible for sediment ingestion pathway. Significant quantity of arsenic contaminated sludge generated from extraction process.

TABLE 15 (Cont'd)

OPERABLE UNIT FOUR (UNION LAKE SEDIMENTS)

SUMMARY OF EVALUATIONS AND COST INFORMATION FOR EACH ALTERNATIVE

Assessment Factors	Alternative 3B	Alternative 3C	Alternative 3D	Alternative 5
Long Term-Effectiveness				
-Magnitude of Residual Risks	Same as Alternative 3A. Long-term maintenance and monitoring required for on-site landfill.	Same as Alternative 3A.	Same as Alternative 3C.	Contaminated sediments above action level would remain on-site. Sediment redistribution to top of sand cover could result in a public health risk.
-Adequacy of Control	Same as Alternative 3A. Long-term maintenance required for on-site landfill facility.	Same as Alternative 3A.	Same as Alternative 3A.	Long-term maintenance of sand cover would be required. Additional cover or regrading of cover may be necessary. Long-term monitoring required for remaining sediments.
-Reliability of Controls	Same as Alternative 3A.	Same as Alternative 3A.	Same as Alternative 3A.	N/A
	Same as Alternative 3A. Minimal risk of failure of on-site landfill facility.	Same as Alternative 3A. Minimal potential of leachate from delisted sediments deposited in lake.	Same as Alternative 3A. Minimal potential of leachate from delisted sediments deposited on the plant site.	Reliability of sand cover to prevent ingestion of sediments unknown. Significant long-term maintenance of cover required to prevent exposure of sediments.
Reduction in Toxicity, Mobility or Volume				
-Treatment Process and Remedy	Same as Alternative 3A.	Same as Alternative 3A. Reduction in toxicity and mobility of sediments.	Same as Alternative 3A.	No reduction in toxicity or volume of waste. Arsenic mobility would be reduced. Contaminated sediments left uncovered may redistribute to areas of potential public risk.
-Amount of Hazardous Material Remaining	Same as Alternative 3A.	Same as Alternative 3A.	Same as Alternative 3A.	All material remaining in place.

TABLE 15 (Cont'd)

OPERABLE UNIT FOUR (UNION LAKE SEDIMENTS)

SUMMARY OF EVALUATIONS AND COST INFORMATION FOR EACH ALTERNATIVE

Assessment Factors	Alternative 1	Alternative 2A	Alternative 2B	Alternative 3A
Reduction of Toxicity, Mobility, or Volume (Cont')				
-Irreversibility of Treatment	N/A	Treatment is essentially irreversible.	Same as Alternative 2A.	Treatment is essentially irreversible.
-Type and Quantity of Residual Waste	N/A	Treated waste expected to be delistable.	Same as Alternative 2A.	Treated waste expected to be delistable. Arsenic sludge generated from extraction process highly contaminated.
Implementability				
o Technical Feasibility				
- Ability to Construct Technology	No difficulty.	Standard equipment. Commercially available.	Same as Alternative 2A.	Standard equipment commercially available.
- Reliability of Technology	No technology.	Well developed and proven technology. Pilot scale studies required to optimize treatment. Excavation of exposed sediment would be more reliable than hydraulic dredging due to an increase in operational control.	Same as Alternative 2A.	Well developed and proven technology. Pilot scale studies required to optimize treatment. Excavation or exposed sediment would be more reliable than hydraulic dredging due to an increase in operational control.
- Ease of Undertaking Additional Remediation, If Necessary		Additional future remedial actons may be required.	Same as Alternative 2A.	Additional future remedial actions may be required.
- Monitoring Considerations	Long-term monitoring required. Monitoring analysis techniques available.	Long-term monitoring required.	Long-term monitoring for on-site landfill and remaining sediment required. Monitoring analysis techniques available.	Long-term monitoring required.
		Monitoring would be required throughout the remediation to ensure the removal of the sediments identified as a potential public health risk.	Same as Alternative 2A.	Monitoring would be required throughout the remediation to ensure the removal of the sediments identified as a potential public health risk.

TABLE 15 (Cont'd)

OPERABLE UNIT FOUR (UNION LAKE SEDIMENTS)

SUMMARY OF EVALUATIONS AND COST INFORMATION FOR EACH ALTERNATIVE

Assessment Factors	Alternative 3B	Alternative 3C	Alternative 3D	Alternative 5
Reduction of Toxicity, Mobility, or Volume (Cont')				
-Irreversibility of The Treatment	Same as Alternative 3A.	Same as Alternative 3A.	Same as Alternative 3A.	No treatment.
-Type and Quantity of Residual Waste	Same as Alternative 3A.	Same as Alternative 3A.	Same as Alternative 3A.	No treatment.
Implementability				
o Technical Feasibility				
-Ability to Construct	Same as Alternative 3A.	Same as Alternative 3A.	Same as Alternative 3A.	Standard equipment and material.
-Reliability of Technology	Same as Alternative 3A.	Same as Alternative 3A. Reliability of lake deposition of delisted sediments is high.	Same as Alternative 3A. Reliability of plant site deposition is high.	Reliability of effectiveness of sand cover is unknown. Expected to be fairly good.
	Same as Alternative 3A.	Same as Alternative 3A.	Same as Alternative 3A.	Same as Alternative 3A.
-Ease of Undertaking Additional Remediation, If Necessary	Same as Alternative 3A.	Same as Alternative 3A.	Same as Alternative 3A.	Same as Alternative 3A.
-Monitoring Considerations	Same as Alternative 3A. Long-term monitoring for on-site landfill required. Monitoring analysis techniques available.	Same as Alternative 3A.	Same as Alternative 3A.	Same as Alternative 3A.
	Same as Alternative 3A.	Same as Alternative 3A.	Same as Alternative 3A.	Same as Alternative 3A.

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July 31st, 1989

Dr. Ferdinand Cataneo
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RE: RI/FS on Vineland Chemical Co., Inc.
Plant Site Source Control, Plan Site Management,
River Area Sediments, and Union Lake Sediments

Dear Dr. Cantaneo:

The 11 volumes on REM III Program RI/FS as above noted have been reviewed to a limited extent during the 30 day public comment period provided. A period of time far longer than 30 days is necessary to adequately and fully analyze all of the data, reports, recommendations, and assumptions made in the volumes.

Reference is made to Table 1-1, Page 1-2 of the "Vineland Chemical Company Site, Final Draft, Feasibility Study Report, Union Lake, Vineland, New Jersey" (1). The time period required by EBASCO to move from its Draft Document to Final Draft Document for "Plant Site RI," "River Area R/I," "Union Lake R/I," for the most part covered at least an 11 month time period. The time period required for EBASCO to move from the draft stage to the final draft on the "Plant Site F/S," on the "River Areas F/S," and "Union Lake F/S" for the most part covered a period of at least 10 months. It is improper to assume that an adequate and full response to the final documents can thereafter be made within a 30 day period. Accordingly, in making this response to the RI/FS, the Vineland Chemical Co., Inc. (hereinafer referred to as "ViChem") will attempt to assert what appears at this time to be the most objectionable and questionable aspects of the RI/FS without waiving its rights to comment upon or assert other criticisms and inadequacies of the RI/FS in future proceedings.

There are so many technical and factual inaccuracies in the 11 volumes of reports that months of time would be needed to correct those deficiencies. Only as an example of some of the inaccuracies a "technical deficiency" sheet is appended for illustration purposes (2).

Beyond the "technical deficiencies" examples (2), the following presently appear as substantive inaccuracies or inadequacies of the 11 volume RI/FS:

(1) Page I-20 of the "Vineland Chemical Company Site, Final Draft, Feasibility Study Report, Union Lake, Vineland, New Jersey" notes that in April, 1986 "The NJDEP advised Vineland Chemical Company of its intent to deny" the NJPDES Permit. Under permit issued in 1979, and again in 1981, [Administrative Consent Order of December 21, 1981] (3), ViChem was authorized by the New Jersey Department of Environmental Protection to discharge 200,000 gallons per day of non-contact cooling water into an unlined lagoon, and to treat ground waters and surface waters containing arsenic for discharge to the same unlined lagoon provided the treated effluent prior to discharge was at a level of .7 ppm arsenic, or less. Various grounds were provided by the NJDEP for denial of the already existing permit and allowance to treat as above noted. The RI/FS notes that the "NJDEP permit denial is being appealed by ViChem."

As Project Engineer, you should be aware that an extensive trial took place before the Office of Administrative Law of the State of New Jersey on the claim by the NJDEP that ViChem's permit to discharge should be denied. In a decision dated July 10, 1988, Judge David J. Monyek, A.L.J. reversed all aspects of the NJDEP determination and held that ViChem had since 1979 been issued an appropriate Discharge Permit as specified above, and that the DEP had not taken the position that ViChem had ever violated the same. Judge Monyek further determined at Page 19 of his Opinion, that:

> "The proofs, when viewed in their totality, do not support respondent's (NJDEP) reasons for the denial of appellant's (ViChem) application. Respondent (NJDEP) failed to present competent credible evidence to support its position that appellant's (ViChem) discharges push contaminated groundwater to the Blackwater Branch and

> downstream faster than would otherwise be the case. Respondent (NJDEP) neither knows nor determined how much more arsenic enters the Blackwater Branch in any given time frame with or without discharges. Respondent (NJDEP) further acknowledged that terminating appellant's (ViChem) discharges would not improve water quality in the Blackwater Branch and would not eliminate the potential need for a Superfund cleanup downstream of the site. Furthermore, respondent (NJDEP) acknowledges that there is no evidence that the upper and lower aquifers are hydraulically connected under the site. Respondent (NJDEP) further failed to support its position that the deep aquifer and the City of Vineland's water supply are in any way threatened by or because of appellant's (ViChem) discharges, and further failed to demonstrate that private wells in the shallow aquifer are threatened. In sum, respondent's (NJDEP) proofs were, at best, hypothetical, speculative and conjectural, and therefore its reasons for the denial were not competently supported. On the other hand, appellant's (NJDEP) proofs were both credible and convincing. The totality of the proofs, as well as the applicable regulatory provisions, preponderate in favor of appellant (ViChem)." (4)

Judge Monyek, at Page 15 of his Opinion, also determined that:

> "Respondent (NJDEP) produced no competent credible evidence to support a hypothesis that arsenic found in Union Lake and its sediments poses a significant threat to public health, safety or the environment, and therefore the denial of a permit based upon such a hypothesis is untenable.".

Similarly, the United States Department of Health and Human Services through the Agency for Toxic Substance and Disease Registry in June, 1987, determined (based upon 1986 and 1987 data collected by the NJDEP and EBASCO) that:

"The Agency for Toxic Substance and Disease Registry does not believe that the exposure of the Lake bottom sediments presents a significant opportunity for excessive exposure to arsenic or a threat to public health to the community by any route of exposure." (5)

Accordingly, Judge Monyek's Opinion, and the Risk Assessment Report of the Department of Health and Human Services points to two fundamental and substantive comments that need be made: (a) ViChem's NJPDES Permits were appropriately granted in 1979, and ViChem has at all times properly operated its treatment plant and discharges of treated effluent and non-contact cooling waters, as well; (b) The only two independent bodies (Judge Monyek and the Agency for Toxic Substance and Disease Registry for the United States Department of Health and Human Services) hearing evidence and removed from the political motivations of the EPA and DEP as they relate to ViChem have determined that on the basis of real scientific evidence, (and not supposition, conjecture and assumptions which has been the practice of the EPA and DEP, and which continues in the RI/FS to be the overriding rule) the arsenic found in Union Lake and its sediments pose no threat to public health or to the community by any route of exposure.

A third opportunity to present evidence to an independent body (the Office of Administrative Law of the State of New Jersey) on the issue as to whether the soils at the plant site pose any threat to the public health or community has been thwarted by the recent withdrawal of the NJDEP of its Closure Order of September 13th, 1988, concerning a "lined lagoon" and lined "concrete pit." On the eve of trial set for August 2, 1989, the NJDEP after receiving great "political fanfare" in issuing a $7 million Closure Order, has unilaterally withdrawn it, full well realizing that it would again lose its case if competent scientific information was allowed to be presented to an independent body. The scientific fact remains that the plant site soils and ground waters, the river area, and Union Lake waters and sediments present no threat to public health or to the community by any route of exposure as a result of the small amounts of arsenic and species of arsenic contained and fixed therein.

Similarly, in the event the RI/FS as presented to date were at some future time to be reviewed by an independent body, the arbitrary and capricious assumptions and political motivations which are its driving force would and, will become clear, as the result of the fundamental and credible scientific facts which the EPA and DEP continue to ignore.

(2) On May 9th, 1986, the EPA authorized EBASCO Services, Inc. (EBASCO) to conduct the RI/FS which is now subject to

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[1] In discussions with the DEP, the EPA has relied upon the same employees of DEP who have continually made improper and erroneous assumptions regarding this matter.

comment. The final drafts of the RI/FS were not completed until June 23, 1989, a period of over three years since authorization. Despite that length of time, and the sampling collected and analyzed for or by EBASCO, and other data reviewed by EBASCO, the EPA has presented a fundamentally flawed RI/FS because of the following erroneous determination:

> "The ViChem plant was shown to be the only significant source of arsenic to the Maurice River drainage basin. All river sections downstream from the site showed elevated levels of arsenic in both water and sediments. The levels of arsenic in all of the other tributaries studied were very low to undetected. Small sources below the Union Lake Dam cannot be ruled out but no evidence exists for any inputs." (Vineland Chemical Company, Union Lake Study at Page I-34.)

EBASCO erred by failing to sample every branch and tributary for the possible presence of arsenic in its waters or soils to ascertain whether other significant sources of arsenic may have contributed to the Maurice River drainage basin. The surface water and sediment "collection stations" are detailed as "Phase I" and "Phase II" at Pages 210 through 218 of the "Vineland Chemical Company Site, Final Draft, Remedial Investigation Report, River Areas, Vineland, New Jersey" (6). Conspicuously absent from any surface water and sediment "collection stations" and surface water and sediment sampling is the area close to or approximating the source of the Tarkiln Branch.

ViChem, having received some information that EBASCO believed that hundreds of metric tons of arsenic had flowed from the ViChem site into the Maurice River drainage basin, set upon an extensive investigation of the tributaries and branches leading into the Maurice River Drainage Basin. In the event it were accurate that EBASCO was estimating that hundreds of metric tons of arsenic had flowed from the ViChem site into the Maurice River Drainage Basin, it was evident to representatives of ViChem that another significant source of arsenic had to have been present for those amounts could not possibly have come from the ViChem site. Accordingly, the comprehensive water and sediment sampling of the branches was implemented, and as noted, has not been conducted by EBASCO.

Sampling of the soil sediment at the source of the Tarkiln Branch, near the intersections of Chestnut Avenue and South West

Boulevard consistently measured at levels approaching 100 ppm arsenic. The water covering the sediments at that location is far less than two and one-half feet, and the Tarkiln Branch passes near two apartment developments, a Little League field, and a number of business locations. Other sampling points of the sediments in the middle portion of the Branch show levels at 45 ppm arsenic, and at 98 ppm arsenic near the Tarkiln Branch's confluence with the Parvins branch. (7). The windsor mean of sediment samples taken at Union Lake is 74.2 ppm arsenic.

ViChem's laboratory performing the sampling is certified in arsenic sampling by the NJDEP.

Realizing that the results of the sediment samples taken at the source and in the Tarkiln Branch suggested the possibility of a significant source of arsenic to the Maurice River Drainage Basin, representatives of ViChem reviewed the records of the Vineland Historical Society to determine whether any arsenic manufacturing plant may have been present at the South West or South East Boulevard intersections with Chestnut Avenue. A Monograph of the Mercantile Industrial and Professional Interests of Pictorial Vineland dated 1920 was found in the Vineland Historical Society files (8). The Monograph contained an advertising for the "Kil-Ton Company", manufacturers of agricultural sprays and chemicals including Sulpho Arsenate and Cross Green Arsenate of Lead, inorganic arsenical compounds (8). Boyd's Directory of Vineland, New Jersey (1921) at Page 118 noted the officers of Kil-Tone Company and its business of manufacturing agricultural chemicals being located at Chestnut Avenue and South East Boulevard (9). Polk's Vineland Directory (1924-1925) provided similar information (10). A title search on the property located at the South East Boulevard and Chestnut Avenue revealed that the owner prior to the Kil-Tone Company was an organization known as Fowler Waste Manufacturing Company, a New Jersey Corporation which in 1917 deeded the property to the Kil-Tone Company. The Kil-Tone Company and the Lucas Kil-Tone Company owned and appeared to have operated the agricultural chemicals manufacturing plant at the site for over twenty years (11).

Within a short period of time that ViChem has had to investigate this significant source of inorganic arsenic to the Maurice River Drainage Basin, ViChem has none the less located a witness who recalls that a white powder was on the streets and roofs of the manufacturing plant, and in the Tarkiln Stream flowing past the area. The witness recalls disposals of Paris Green, an inorganic copper arsenic compound, being placed into the Tarkiln Stream. The witness' observations were made during the time the company was doing business as Lucas Kil-Tone. The witness also recalls Lucas Kil-Tone having manufactured calcium compounds and that the discharge practices into the stream caused a large area to be stunted of tree and vegetation growth from the Lucas Kil-Tone site to a point down Tarkiln Stream at an area where the Tarkiln Senior Citizen complex is currently located.

The historical confirmation provided by the literature search thus far conducted corroborates the evidence of the source of inorganic arsenic to the Maurice River drainage basin. The presence to this day of soil/sediments in the Tarkiln Branch at levels close to and exceeding 100 ppm arsenic suggests the following:

(A) A significant source of inorganic arsenic, the arguable effects of which are apparent more than a half century after production, have not been discovered, ascertained, quantified and factored into the analysis of the RI/FS.

(B) While ViChem disagrees with the EPA recommended remedial action for treating sediments in Union Lake and the Rivers Area, ViChem must point out that the criterion adopted for sediment treatment would apply as well to the Tarkiln Branch.

(C) The RI/FS at I-23 of the "Vineland Chemical Company Site, Final Draft, Feasibility Study Report, Union Lake, Vineland, New Jersey" expresses concerns that anaerobic conditions developing on the bottom of Union Lake would readily convert the claimed ViChem organic arsonicals into the more toxic inorganic arsenic forms. Indeed, at Page I-34 of the same RI/FS report, a determination is made that the inorganic arsenicals, arsenate species, and the arsenite species are the predominating arsenical forms, although fixed in the sediments. While some limited conversion of the claimed ViChem arsonicals may be expected, the more toxic forms of inorganic arsenicals developed on the bottom of Union Lake would appear to be the Kil-Tone and Lucas Kil-Tone discharges.

(D) That being the case, (a) extensive speciation (12) and column layer studies differentiating the presence of organic and inorganic arsenic over time, are necessary to ascertain the extent of any claimed contribution from the two potential sources, and (b) the only appropriate test under CERCLA to determine the hazardous nature or non-hazardous nature of the arsenic present in the sediments from the two potential sources is the test for "characteristics" by the EP Toxicity Test for arsenic. Under that test, as the EPA and DEP is aware, none of the sediments in Union Lake are hazardous (13), and none of the sediments in Union Lake can be brought under Superfund Remediation Programs.

(E) No risks can be attributable to the claimed ViChem organic arsonicals that may be present in the sediments of Union Lake, and any risks determined in the RI/FS as a result of the presence of arsenic in the sediments of Union Lake are attributable solely to the far more toxic inorganic arsenicals of which ViChem is not the source.

(F) As will be more fully discussed in a separate section, the Risk Assessment in the RI/FS is seriously flawed even in evaluating its concerns with inorganic arsenic. None the less, no risk of exposure is present even as to the inorganic arsenic found in the sediments. The appropriate remedial action in the Union Lake is no action and no sediment treatment, allowing nature to proceed on its course. That is what has occurred over the last 50 years with the Kil-Tone discharges of inorganic arsenic and wastes placed into the Tarkiln Branch and the Maurice River drainage basin. The natural process is so effective, no one over the years has even been aware of any potential risks. The wisdom of that approach is again fostered by reference to the EP Toxicity Test which is the only possible applicable criterion set by law for determining whether the sediments in Union Lake are hazardous. As previously referenced, the application of the EP Toxicity Test to the sediments in Union Lake has uniformly determined that the sediments are not hazardous.

(G) Should the EPA, however, continue to assert that the preferred option for the Union Lake area is sediment treatment, further speciation and column layer studies differentiating the presence of organic and inorganic arsenic species over time are also necessary in the event the EPA attempts to attribute responsibility for the Union Lake treatment to ViChem. ViChem was not the manufacturer of the more toxic inorganic arsenicals, any responsibility for which belongs to Kil-Tone and Lucas Kil-Tone, the mixed funding provisions of CERCLA, and the State of New Jersey as the owner of Union Lake (see Page E-5 and I-4 of "Vineland Chemical Company Site, Final Draft, Feasibility Study Report, Union Lake, Vineland, New Jersey.")

(3) The RI/FS Risk Assessment is seriously flawed. Instead of performing an objective Risk Assessment on current data, the EPA/DEP in the RI/FS has performed a biased Risk Assessment on old data. The goal of requiring sediment treatments in certain locations to meet "clean up" standard of 20 ppm arsenic in the sediments was set by the NJDEP in its draft conference with the EPA. Thereafter, the Risk Assessment was constructed, and indeed manipulated, to reach the previously determined "clean up" goal of 20 ppm set by the NJDEP.

Page 3-8 of the Executive Summary found in "Vineland Chemical Company Site, Final Draft, Feasibility Study Report, Union Lake, Vineland, New Jersey" more than suggests that prior to DEP's comments into the RI/FS, the EPA was going to use the correct and legally authorized EP Toxicity Test of 5 ppm arsenic to determine risks and whether the sediments and soils were hazardous under CERCLA. As previously noted, none of the sediment samples, and none of the samples at the Vineland Chemical site exceed EP Toxicity limits.

To the contrary, the NJDEP has been using an "Informal Guideline" of 20 ppm arsenic, and not the legally required EP Toxicity Testing, for a clean-up standard in soils and sediments. The "Informal Guideline" is not based upon any regulation or law. However, the NJDEP has adopted that number in its ECRA clean-ups, and other clean-ups required under other laws. The "Informal Guideline" has no basis in the scientific literature, and indeed is a "secret law" component of what the NJDEP does in clean-ups. No one knows the basis upon which the 20 ppm "Informal Guideline" has been set. The NJDEP consistently has used the "Informal Guideline" in setting clean-up goals and standards, but the DEP has also claimed that "it really isn't doing so" because the 20 ppm standard is only an "Informal Guideline," yet it controls and drives the DEP policy on clean-up.

The fact that the 20 ppm "Informal Guideline" would be used in this RI/FS as a clean-up treatment standard for the sediments at certain locations was predictable. The fact that it is being used is particularly disturbing for the above-noted reasons, as well as the EPA review of actual arsenic standards that it is currently inclining to conclude that arsenic standards have been too stringently set. However, guided by the NJDEP "Informal Guideline," the Risk Assessment was constructed in a manner to assure that its results "backed into" the previously set objective by the NJDEP of a 20 ppm clean-up threshold for certain of the sediments at Union Lake.

The DEP had other reasons, as well, to become actively involved in setting the clean-up threshold, and other key measurement criteria used in the RI/FS. The DEP owns Union Lake. The DEP is a potentially responsible party. Its active and biased participation in the process of the RI/FS with the EPA is essential to assuring that (a) the DEP will not be determined a potentially responsible party, and (b) at the same time clean-up its lake well beyond any requirements of law. As the result of DEP's ownership position of Union Lake, its bias resulting therefrom, as well as its insistence to impose the "Informal Guideline" of 20 ppm as the clean-up standard for certain areas of Union Lake, the DEP should not have been allowed to participate at all in the RI/FS process by way of field sampling, and active comment in the drafting of the RI/FS.

The manner in which EBASCO used a "back door" approach in its Risk Assessment to result in the predetermined conclusion that 20 ppm arsenic would compose a portion of the clean-up standard for Union Lake, follows:

A. ANTIQUATED DATA. The Risk Assessment for the sediments of June 1989 is based upon 1982, 1983, 1986 data compiled by both the NJDEP and EBASCO. With the exception of the 1982, 1983 and April 1986 data, the Agency for Toxic Substances and Disease Registry of the Department of Health and Human Services thoroughly reviewed the June and August 1986 data and issued its report in June 1987 determining that there was no threat to public health by any route of exposure including injestion and/or inhalation of Union Lake sediments.

One of the key focal points even recognized by EBASCO is the need to determine the extent of the positive effects of "natural cleansing" of the Union Lake sediments. It is therefore necessary to use and develop the most recent data possible. EBASCO and the NJDEP have failed to do so. The Risk Assessment is based upon data developed 3 1/2 years ago, and in all probability has no applicability to current conditions. Clearly, from the work of the Department of Health and Human Services previously referenced, it is possible to develop a Risk Assessment within one year of the collection of data. To attempt to rely upon a Risk Assessment, however otherwise flawed, developed 3 1/2 years after obtaining sample data points and the data information is totally unacceptable, legally and scientifically, particularly given EBASCO's recognition of the natural cleansing dynamics and the decreasing amounts of arsenic that can be expected to be found, over time, on the surface sediments.

B. SUSPECT DATA. No validation of the NJDEP's surface sediment sampling data appears other than the conclusory statement in the RI/FS executive summary that "the NJDEP's data have been reviewed and validated."

No discussion describing the validation of the NJDEP's surface sediment data developed in August 1986 has been made part of the RI/FS. Indeed, the protocal, quality assurance/quality control documents and procedures, laboratory results, and chain of custody documents of the NJDEP August 1986 series of the surface sediment sampling have not at all been made a part of the RI/FS with the exception of two maps, Figures 4-3 and 4-4, showing sample stations and the results of sampling. No other key critical information is provided so that a review of the quality control/quality assurance of that series of samplings can be accomplished during the comment period, or even observed by a reader of the RI/FS.

The limited amount of information provided in the RI/FS about the sediment core sampling taken by the NJDEP in August 1986 (pp. 4-17, 4-18 and Table 4-3) raises even more concerns concerning the quality control/quality assurance of the surface sediment samplings of that year.

The limited discussion of the 1986 EBASCO data on page 4-12 raises concerns as well as to the quality assurance/quality control and validity of the June 1986 EBASCO data. The suggestion is raised at page 4-12 that the EPA's data validation standard operating procedures were violated. Nonetheless, EBASCO determined its sampling results to be appropriate. Quoting from the RI/FS at page 4-12: "the high concentration levels present in the Union Lake sediment samples in relation to the levels found within the blanks (generally several orders of magnitude difference), negate the severity of violating these criteria set forth in EPA's data validation standard operating procedures." Additionally, the EBASCO report notes, again at page 4-12, that "some concentrations were estimated due to poor precision among laboratory duplicates."

Indeed, the duplicate sediment samples taken at EL-8 on June 29, 1986 were at highly unacceptable variances given their results as being 29 ppm arsenic, and 107 ppm arsenic. The RI/FS attempts to dismiss such high variability by stating at Page 4-12, "considering the high arsenic levels found in the Lake samples (up to 107 mg/l), the high variability seen within the duplicates is not anomalous or unexpected." But, indeed it is. For example, the Storch results, presumably validated (the basis of which has not been provided), of the April 1986 DEP testing show its duplicate sediment samplings with low variability at 96.3/117 ppm and 24.5/13.9 ppm (13).

At the conclusion of page 4-12, the RI/FS notes that some data has been rejected but does not indicate the reasons for the rejection, nor the reasons why other data has not been rejected, and has been accepted.

C. IMPROPER DATA PLOTTING. There is no ability to determine whether the August 1986 NJDEP data, even without quality control/quality assurance, has been appropriately plotted on Figure 4-4. The matter is of concern because the small number (11) of EBASCO June 1986 sediment surface sampling results have not ever been appropriately plotted. Eleven sediment sample results from the June 1986 EBASCO sampling round are noted on Table 4-5 under "total arsenic." As examples, the result noted in Table 4-5 for sample point EL-3 is "non-detectable," and for sample point EL-5 is 12 ppm arsenic. However, the amounts plotted on Figure 4-4 for sample point (for windsoring calculations) EL-3 is 31 ppm arsenic, and for EL-5 is 111 ppm arsenic. The latter results were obtained by EBASCO from a different testing procedure, HSL Inorganics, and should not appear on Figure 4-4 to assure consistency that only total arsenic levels obtained from the same testing series appears on Figure 4-4.

The divergence of results from samplings taken at stations EL-3 (ND and 31) and EL-5 (12 and 111) depending upon the total arsenic sampling protocal series or the use of the HSL Inorganics protocal series, raises additional concerns with the high variability of the duplicate sample results, and more than suggests, once again, that EPA's data validation standard operating procedures have been clearly violated.

D. RISK ASSESSMENT OF THE DEPARTMENT OF HEALTH AND HUMAN SERVICES. Even assuming the validity of some or most of the data generated by EBASCO in June 1986, and by the DEP in August 1986, the United States Department of Health and Human Services in June 1987, determined that based upon that data, no threat to public health existed as the result of any route of exposure, including injestion or inhalation of the sediments. The June 1987 analysis appropriately realized the small number of sediment surface samples appearing above 500 ppm arsenic, and compared the average concentration of arsenic in the sediments to studies that provided even more of an opportunity for exposure to arsenic soils and sediments than the assumptions adopted by the EBASCO Risk Assessment at Section 7 of the "Vineland Chemical Company Site, Final Draft, Remedial Investigation Report, Union Lake, Vineland, New Jersey." The determination made by the United States Department of Health and Human Services has already been noted.

E. EBASCO RISK ASSESSMENT. The EBASCO Risk Assessment compares "apples to oranges" in its attempt to "work back" and reach the determination that some risk from the sediments exists to justify a 20 ppm clean-up "standard." The Risk Assessment adopts a series of untenable assumptions. The Risk Assessment sets up the scenario that swimmers are possibly at risk from injesting and contact with sediments, primarily at depths less than 2 1/2 feet. To determine what the risk would be at depths of less than 2 1/2 feet, the Risk Assessment computes a "worst case exposure assumption" based not upon the conditions found in 1986 at a depth of 2 1/2 feet or less, but on the one data point of the highest one measurement of arsenic in sediment surface (1273 ppm) found miles from any beach area or level of water at 2 1/2 foot depth or less. Similarly, the windsorized mean value used by EBASCO to determine the most probable case exposure assumption to arsenic sediments at a depth of 2 1/2 feet or less (the defined area of concern at which supposed exposure to the sediments can assumedly occur), was the windsorized mean value for all of the lake sediments including points miles from any beach area and miles from the actual conditions as they existed in 1986 at depths of 2 1/2 feet or less (instead of the windsorized mean value for the conditions found in 1986 at a depth 2 1/2 feet or less or near the beach). Due to the high variability of sediment samples which the RI/FS theorized as reason to attempt validation of the EBASCO 1986 sediment sampling, the only reasonable "worst case exposure assumption" that can objectively be made, would be based upon the windsorized mean value for all of the Lake sediments (worst case exposure assumption risk at 6X 10-6). The most probable case exposure assumption using the conditions occurring in 1986 at the at the area of concern being less than 2 1/2 feet in depth has not been computed in the RI/FS because upon that basis no risk of exposure exists through injestion or inhalation of the sediments or any other route of exposure, as corroborated by the June 1987 study (5).

4. The failure to speciate sediment samples (Vineland Chemical Company Site, Final Draft, Remediation Investigation Report, Union Lake, Vineland, New Jersey at pages 7-18) resulted in adopting erroneous assumptions basing the Risk Assessment upon the assumed overwhelming presence of the most toxic form of arsenic, inorganic arsenic. While the Kil-Tone Company and Lucas Kil-Tone Company provided a source of inorganic arsenic into the Maurice River drainage basin, speciation of sediment samplings should have taken place to determine the exact extent of any inorganic arsenic in the sediment samples.

5. The RI/FS Risk Assessment suggests that lead was the "other indicator chemical of concern." The source of any lead would have been the Kil-Tone Company and Lucas Kil-Tone from its disposals and handling of Green Cross Arsenate of lead. Any presence of lead, again corroborates a significant source of inorganic arsenic in the Maurice River drainage basin sediments as being from the Kil-Tone Company.

6. As previously noted (13), the EP Toxicity Test for arsenic conducted upon the sediments in the Union Lake resulted in the determination that the sediments of the Union Lake are not hazardous. Similarly, the EP Toxicity Test determined that the soils at the Vineland Chemical site are also non-hazardous because the arsenic is so firmly bound in the soils that a toxic amount does not leach from the soils when exposed to waters and rain (14). Accordingly, not only the Union Lake sediments, but the soils at the Vineland Chemical site are not hazardous, and cannot be remediated under CERCLA.

In an attempt to avoid this result, the DEP has, contrary to law, made the assumption that all arenic present at the ViChem site and off site is K031. There is no law or regulation which so states. The only applicable test to determine toxicity and possible applicability of CERCLA to the arsenic in the sediments and soils is the characteristic test of EP Toxicity for arsenic (13). Indeed, in 1987, the DEP formally characterized the sediments of the Union Lake as non-hazardous under the EP Toxicity Test (13). Prior to the final draft stage of the RI/FS, it appears that the

EPA made a similar determination that the EP Toxicity Test is the appropriate measure to be used to determine risks and hazards (see page 3-8 of the "Vineland Chemical Company Site, Final Draft, Remedial Investigation Report, Union Lake, Vineland, New Jersey").

7. The water threshold of 0.05 ppm arsenic adopted by the EPA is also improper inasmuch as it assumes the presence of inorganic arsenic, the more toxic form of arsenic (12). Organic arsenic is overwhelmingly present in the waters, and requires a different standard, such as 0.7 ppm (3) (4) (12).

Similarly, the delisting VHS model is based upon the wrong "hypothetical 'in the well' concentration of .05 ppm arsenic" which improperly assumes the presence of the most toxic form of arsenic. The target delisting criterion originally adopted by the EPA as the EP Toxicity Test of 5 ppm was the appropriate criterion, and was controlling prior to the participation of the DEP in the RI/FS process.

Very truly yours,

FRANKLIN J. RIESENBURGER

FJR/fr
Enclosures

FEDERAL EXPRESSED 8/1/89

(2)

EXAMPLES OF TECHNICAL DEFICIENCIES

TECHNICAL DEFICIENCIES

(Illustrative Only)

Erroneous Executive Summary Conclusions at Page:	Correct Information
E-1, 1-7, 1-18, asserting that ViChem has manufactured organic arsonicals at the ViChem plant site since 1949.	1953 - 1954
E-6, characterization of sediments as KO31 based upon a "belief".	Characterization cannot take place upon a "belief". Regulations require application of EP Toxicity Test. Sediments in Union Lake are from multiple sources.
E-6, claiming that the Union Lake and Rivers are also part of the "area of contamination" from the site and appropriately a part of the RI/FS.	Only the ViChem site has been placed on the NPL after MITRE evaluation.
1-1, implying that the EPA appropriately authorized EBASCO to proceed with RI/FS.	EPA illegally took over the RI/FS process that had been previously conducted in good faith by ViChem.
1-12, distribution of treatment system references 2,000 to 5,000 gallons per day of process water.	Process water design in treatment system was modified by subsequent filings and drawings after January 30, 1979.

Erroneous Executive Summary Conclusions at Page:	Correct Information
1-17, the RI/FS notes that the interim standard for treatment works was set at .7 ppm "agreed to and ordered by NJDEP in December 22, 1981 with the understanding that the .05 mg/l level would eventually be met.	No such words appear in the Administrative Consent Order of December 21, 1981, a copy of which is set forth as Item (3) appended hereto. Paragraph 12 of the Administrative Consent Order of December 21, 1981, states as follows: "While the proposed experimental testing is being conducted and until such time as a decision is made by the NJDEP on the achievability of 0.05 mg/l effluent limit, ViChem may only discharge its treated water into the unlined lagoon at a level of total arsenic concentration of not more than 0.7 mg/l." See Judge Monyek's decision at page 15, Item (4) attached.
1-17, the RI/FS references the above noted Administrative Consent Order as being dated December 22, 1981.	The correct date is December 21, 1981.
1-17, the RI/FS states that ViChem "ceased pumping and treating ground water in. July 1987 with the consent of the NJDEP. One of the reasons the NJDEP allowed ViChem to stop pumping and treating..."	ViChem never applied or requested the right to cease treating and pumping the ground water. Because of its obligation to treat the ground water under the Administrative Consent Order of December 21, 1981, ViChem was subjected to conflicting obligations i.e. the treatment system which included approvals for the use of two lined surface impoundments was required to treat and pump ground waters at the same time that a federal action had been brought seeking

Erroneous Executive Summary Conclusions at Page:	Correct Information
	to require ViChem to cease using the two lined surface impoundments. As a result of those conflicting agency positions, the DEP on its own removed the obligation of ViChem to pump and treat ground waters.
1-18, suggests that a Court Order was in place as of February 8, 1971 requiring ViChem to install and provide an industrial waste water treatment facility.	Such was not the case. See Judge Monyek's decision, Item (4) attached, at pps. 4-5.
1-29, suggests that the claimed contamination may impact upon drinking waters.	Such is not the case. Any contamination of the ground waters under the ViChem site is limited to the upper water table aquifer as a result of the banded zone (1-24), and the Maurice River drainage basin is not a part of the municipal water well supplies of the City of Vineland and City of Millville, which draw down approximately 600 feet into the lower water table aquifer.
3-5, the RI/FS intimates that based upon its belief, the arsenic in the sediments of Union Lake are the KO31 materials stored on the ViChem site. The RI/FS claims that the sediments contain the "by-product salts", KO31. Consequently, all arsenic in the	No tests have shown that the sediments are contaminated by the "by-product salts", or that the "by-product salts" are present on or in the sediments. The identification of a significant source of inorganic arsenic from the

Erroneous Executive Summary Conclusions at Page:	Correct Information
sediment has been determined to be K031 per 40 CFR 261.32 which requires that the "sediments contaminated by K031 are considered a listed hazardous waste because they are derived from a listed waste."	Kil-Tone site would make such a determination, which has never been made, impossible. The only applicable test for the soils and sediments is 40 CFR 261.20 and 261.24. 40 CFR 261.32 does not contain the language attributed to it in the RI/FS, nor was constructed for or with the purpose asserted in the RI/FS. 40 CFR 261.24 controls the determination of whether removed or treated sediments or soils are to be classified as a hazardous waste or a non-hazardous waste.

TABLE 15 (Cont'd)

OPERABLE UNIT FOUR (UNION LAKE SEDIMENTS)

SUMMARY OF EVALUATIONS AND COST INFORMATION FOR EACH ALTERNATIVE

Assessment Factors	Alternative 1	Alternative 2A	Alternative 2B	Alternative 3A
o Administrative Feasibility				
-Ability to Obtain Approvals	Permits not required.	Delisting approval required from NJDEP.	Delisting approval required from USEPA Region II. As the site is a CERCLA site, permits for on-site landfill are not required.	Delisting approval required from NJDEP
-Coordination with Other Agencies	Coordination required.	Coordination required.	Intensive coordination required for on-site landfill facility.	Coordination required for identification of off-site nonhazardous landfill and off-site hazardous treatment and disposal facility.
-Availability of Services and Materials				
-Availability of Treatment Capacity and Disposal Services	Not required.	Treatment capacity and storage capacity are all adequately available. Off-site landfill requires administrative acquisition.	Same as Alternative 2A. On-site landfill provides higher availability for disposal.	Treatment capacity and storage are all adequately available. Off-site nonhazardous and hazardous landfill requires administrative acquisition.
-Availability of Necessary Equipment and Specialists	Not required.	Standard equipment and operations. No specialists required.	Same as Alternative 2A.	Standard equipment and operations. No specialties required.
-Availability of Prospective Technologies	Not required.	Prospective technologies are available. Technologies are proven in Bench-Scale Tests. Pilot studies would be required to optimize process.	Same as Alternative 2A.	Prospective technologies are available. Technologies are proven in Bench-Scale Studies. Pilot-Scale studies required to optimize process.
Cost				
Lake At Its Full Condition				
o Total Capital Cost	$ 44,450	$ 34,591,000	$13,742,000	$ 25,740,000
o Annual Operation and Maintenance Cost	$ 49,455	$ 13,000 Long-term $ 20,562,000 Short-term	$ 90,000 Long-term $20,562,000 Short-term	$ 13,000 Long-Term $ 1,832,000 Short-Term
o Present Worth	$874,245	$ 71,247,000	$51,414,000	$ 29,227,000
Lake At Drawdown Condition				
o Total Capital Cost	Same as Above	$ 32,317,000	$11,467,000	$ 23,973,000
o Annual Operation and Maintenance Cost	Same as Above	$ 13,000 Long-term $ 20,487,000 Short-term	$ 90,000 Long-term $20,487,000 Short-Term	$ 13,000 Long-Term $ 1,808,000 Short-Term
o Present Worth	Same as Above	$ 68,840,000	$49,006,000	$ 27,417,000

TABLE 15 (Cont'd)

OPERABLE UNIT FOUR (UNION LAKE SEDIMENTS)

SUMMARY OF EVALUATIONS AND COST INFORMATION FOR EACH ALTERNATIVE

Assessment Factors	Alternative 3B	Alternative 3C	Alternative 3D	Alternative 5
o Administrative Feasibility				
-Ability to obtain Approvals	Delisting approval required from USEPA Region II. As the site is a CERCLA site, permits for landfill are not required.	Same as Alternative 3A. Approval for lake deposition may be difficult to obtain.	Same as Alternative 3A. Approval for plant site deposition may be difficult to obtain.	Should not pose a problem.
-Coordination with Other Agencies	Intensive coordination required for on-site landfill facility and identification of off-site hazardous treatment and disposal facility.	Intensive coordination required for approval of lake deposition and identification of hazardous treatment and disposal facility.	Coordination required for approval of plant site deposition and identification of off-site hazardous treatment and disposal facility.	Coordination required.
-Availability of Services and Materials				
-Availability of Treatment Capacity and Disposal Services	Same as Alternative 3A. On-site nonhazardous landfill provides higher availability or disposal.	Treatment capacity, storage capacity and disposal capacity are all adequately available.	Same as Alternative 3C.	No treatment or disposal.
-Availability of Necessary Equipment and Specialists	Same as Alternative 3A.	Same as Alternative 3A.	Same as Alternative 3A.	Same as Alternative 3A.
-Availability of Prospective Technologies	Same as Alternative 3A.	Same as Alternative 3A.	Same as Alternative 3A.	Not required.
Costs Lake At Its Full Condition				
o Total Capital Cost	$16,017,000	$11,265,000	$14,746,000	$ 3,145,000
o Annual Operation & Maintenance Cost	$ 60,000 Long-term $ 1,832,000 Short-term	$ 13,000 Long-term $ 1,832,000 Short-term	$ 13,000 Long-Term $ 1,832,000 Short-Term	$ 13,000
o Present Worth	$20,133,000	$14,752,000	$18,233,000	$ 3,369,000
Lake At Drawdown Condition				
o Total Capital Cost	$14,249,000	$ 9,498,000	$12,978,000	$ 2,176,000
o Annual Operation & Maintenance Cost	$ 60,000 Long-term $ 1,808,000 Short-term	$ 13,000 Long-term $ 1,808,000 Short-term	$ 13,000 Long-Term $ 1,808,000 Short-Term	$ 13,000
o Present Worth	$18,323,000	$12,942,000	$16,422,000	$ 2,400,000

TABLE 15 (Cont'd)

OPERABLE UNIT FOUR (UNION LAKE SEDIMENTS)

SUMMARY OF EVALUATIONS AND COST INFORMATION FOR EACH ALTERNATIVE

Assessment Factors	Alternative 1	Alternative 2A	Alternative 2B	Alternative 3A
Compliance with ARARs				
-Compliance with contaminant-specific ARARs	No contaminant-specific ARARs established for arsenic contaminated sediment. Will not meet health based levels.	No contaminant-specific ARARs established for arsenic contaminated sediments. Will meet health based levels.	Same as Alternative 2A.	No contaminant-specific ARARs established for arsenic. Treated sediment will meet health based levels.
-Appropriateness of waivers	Not justifiable.	Treatability variance may be required.	Same as Alternative 2A.	Treatability variance may be required.
-Compliance with action-specific ARARs	All appropriate and relevant RCRA closure/post-closure requirements in 40 CFR 264, 110-264, 120 would not be met.	All action-specific ARARs would be met.	Same as Alternative 2A.	All action-specific ARARs will be met.
-Compliance with appropriate criteria, advisories, and guidance	Not in compliance with state and local criteria and federal advisories.	Would be in compliance with state and local criteria and federal advisories.	Same as Alternative 2A.	Will be in compliance with state and local criteria and federal advisories.
Overall Protection of Human Health and the Environment	Risk of direct contact with contaminated sediment and water controlled but not eliminated. Contaminants remain on-site and their toxicity, mobility or volume unaltered.	Risk of sediment ingestion reduced. Contaminants removed and chemically fixated to reduce mobility. Volume of fixated solids will increase by 17%. Cancer risk levels for those sediments identified as a public health risk reduced to target levels.	Same as Alternative 2A.	Risk of sediment ingestion reduced. Contaminants removed and converted to nonhazardous form. Volume of contaminants slightly reduced. Cancer risk level for those sediments identified as a public health risk reduced to target levels.
State Acceptance	State comments indicated that the no action alternative would be protective of human health through the restricted access to the lake.	General comments received from the State include the need for sampling prior to the initiation of the action to confirm the location of the contaminated sediments. The state also identified the need for an environmental assessment to determine the impacts of dredging.	Same as Alternative 2B.	General comments received from the state include the need for sampling prior to the initiation of the action to confirm the location of the contaminated sediments.
Community Acceptance	No public comments have been received to date.	Community expressed that no action would be the preferred alternative in the lake.	Same as Alternative 2A.	Same as Alternative 2A.

TABLE 15 (Cont'd)

OPERABLE UNIT FOUR (UNION LAKE SEDIMENTS)

SUMMARY OF EVALUATIONS AND COST INFORMATION FOR EACH ALTERNATIVE

Assessment Factors	Alternative 3B	Alternative 3C	Alternative 3D	Alternative
Compliance with ARARs				
-Compliance with contaminant-specific. ARARs	Same as Alternative 3A.	Same as Alternative 3A.	Same as Alternative 3A.	Will not meet health based level.
-Appropriateness of waivers	Same as Alternative 3A.	Treatability variance may be required.	Same as Alternative 3A.	Not required.
-Compliance with action-specific ARARs	Same as Alternative 3A.	Same as Alternative 3A.	Same as Alternative 3A.	Same as Alternative 3A.
-Compliance with appropriate criteria, advisories, and guidance	Same as Alternative 3A.	Same as Alternative 3A.	Same as Alternative 3A.	Same as Alternative 3A.
Overall Protection of Human Health and the Environment	Same as Alternative 3A.	Same as Alternative 3A.	Same as Alternative 3A.	Risk of sediment ingestion reduced. Mobility of contaminants reduced. Cancer risk level for those sediments identified as a public health risk reduced to target levels. These contaminants remain on-site.
State Acceptance	Same as Alternative 3A.	Same as Alternative 3A.	Same as Alternative 3A.	Same as Alternative 3A.
Community Acceptance	Community expressed that no action would be preferred alternative in the lake.	Same as Alternative 3B.	Same as Alternative 3B.	Same as Alternative 3B.

TABLE 16

OPERABLE UNIT ONE (PLANT SITE SOURCE CONTROL)
ALTERNATIVE SC-5: IN SITU SOIL FLUSHING

COST ESTIMATES (1989 DOLLARS)

CAPITAL COSTS

FACILITY/CONSTRUCTION		DIRECT CONSTRUCTION COST, $
I.	SITE PREPARATION	57,120
II.	SUPPORT FACILITIES	78,000
III.	SOIL EXCAVATION	1,569,763
IV.	SOIL FLUSHING SYSTEM	765,875
V.	CHICKEN COOP DECONTAMINATION	252,900
VI.	CLOSURE OF LINED LAGOON	373,782
VII.	CLOSURE OF CONCRETE LINED LAGOON	453,196
VIII.	ELECTRICAL	30,000
	TOTAL DIRECT CONSTRUCTION COST (TDCC)	3,581,836
	CONTINGENCY @ 20% OF TDCC	716,367
	ENGINEERING @ 5% OF TDCC	179,092
	LEGAL AND ADMINISTRATIVE @ 2% OF TDCC	71,637
	TOTAL CONSTRUCTION COST	4,548,932

OPERATION AND MAINTENANCE COSTS

SHORT-TERM	68,521
LONG-TERM	11,970

PRESENT WORTH COST (Calculated at a 5% discount rate)	5,158,870

TABLE 17

OPERABLE UNIT TWO (PLANT SITE MANAGEMENT OF MIGRATION) ALTERNATIVE MOM-4A: SITE PUMPING/TREATMENT/REINJECTION/ DISCHARGE TO THE MAURICE RIVER

COST ESTIMATES (1989 DOLLARS)

CAPITAL COSTS

FACILITY/CONSTRUCTION		DIRECT CONSTRUCTION COST, $
I.	SITE PREPARATION	28,560
II.	SUPPORT FACILITIES	78,000
III.	SITE AREA PUMPING AND COLLECTION	849,800
IV.	CHEMICAL OXIDATION SYSTEM	252,050
V.	CHEMICAL PRECIPITATION	1,010,510
VI.	ION EXCHANGE SYSTEM	726,900
VII.	ACTIVATED CARBON ADSORBER SYSTEM	373,750
VIII.	PROCESS PIPING AND I&C	Included in above items
IX.	TREATED GROUNDWATER SYSTEM	241,400
X.	DISCHARGE PIPING SYSTEM TO THE MAURICE RIVER	1,232,610
XI.	INSTRUMENTATION AND CONTROLS	103,000
XII.	ELECTRICAL	30,000
XIII.	UTILITIES	220,000

TABLE 17 (CONT'D)

OPERABLE UNIT TWO (PLANT SITE MANAGEMENT OF MIGRATION)
ALTERNATIVE MOM-4A: SITE PUMPING/TREATMENT/REINJECTION/ DISCHARGE TO THE MAURICE RIVER

COST ESTIMATES (1989 DOLLARS)

CAPITAL COSTS (CONT'D)		
XIV.	BUILDINGS, PLATFORMS AND STAIRS	200,000
XV.	FOUNDATION AND PADS	410,200
	TOTAL DIRECT CONSTRUCTION COST (TDCC)	5,504,730
	CONTINGENCY @ 20% OF TDCC	1,100,946
	ENGINEERING @ 5% OF TDCC	275,237
	LEGAL AND ADMINISTRATIVE @ 2% OF TDCC	110,095
	TOTAL CONSTRUCTION COST	6,991,008
OPERATION AND MAINTENANCE COSTS*		5,155,053
PRESENT WORTH COST (Calculated at a 5% discount rate)		34,147,808

* As the arsenic contaminant plume drops below 0.35 mg/l, extraction wells in these areas may be shut off thus decreasing the annual operation and maintenance cost. The present worth is calculated considering this.

TABLE 18

OPERABLE UNIT THREE (RIVER AREAS SEDIMENTS)
ALTERNATIVE 3C: DREDGING/EXCAVATION/EXTRACTION/FLOODPLAIN REDEPOSITION OF SEDIMENTS/PLANT SITE DEPOSITION OF RIVER SEDIMENTS/OFF-SITE HAZARDOUS SLUDGE DISPOSAL

COST ESTIMATES (1989 DOLLARS)

CAPITAL COSTS

FACILITY/CONSTRUCTION		DIRECT CONSTRUCTION COST, $
I.	SITE PREPARATION	288,592
II.	SUPPORT FACILITIES	78,000
III.	SEDIMENT HYDRAULIC DREDGING	417,352
IV.	SEDIMENT EXCAVATION	747,061
V.	SEDIMENT EXTRACTION SYSTEM	1,052,030
VI.	EXTRACTANT TREATMENT SYSTEM	1,683,715
VII.	FLOODPLAIN DEPOSITION	1,069,514
VIII.	PLANT SITE DEPOSITION	709,858
IX.	OFF-SITE HAZARDOUS DISPOSAL	1,693,125
X.	PROCESS PIPING AND I&C	163,800
XI.	ELECTRICAL	373,400
XII.	BUILDINGS, PLATFORMS AND STAIRS	268,400
XIII.	FOUNDATIONS AND PADS	182,300
	TOTAL DIRECT CONSTRUCTION COST (TDCC)	8,727,146
	CONTINGENCY @ 20% OF TDCC	1,745,429
	ENGINEERING @ 5% OF TDCC	436,357
	LEGAL AND ADMINISTRATIVE @ 2% OF TDCC	174,543
	TOTAL CONSTRUCTION COST	11,083,476

OPERATION AND MAINTENANCE COSTS

SHORT-TERM	1,586,899
LONG-TERM	13,020

PRESENT WORTH COST (Calculated at a 5% discount rate)	14,136,109

TABLE 19

OPERABLE UNIT FOUR (UNION LAKE SEDIMENTS)
ALTERNATIVE 3C: REMOVAL/EXTRACTION/REDEPOSITION OF SEDIMENTS/ OFF-SITE HAZARDOUS SLUDGE DISPOSAL

COST ESTIMATES (1989 DOLLARS)

CAPITAL COSTS

	FACILITY/CONSTRUCTION	DIRECT CONSTRUCTION COST, $
I.	SITE PREPARATION	288,592
II.	SUPPORT FACILITIES	78,000
III.	SEDIMENT EXCAVATION	1,067,791
IV.	SEDIMENT EXTRACTION SYSTEM	1,052,030
V.	EXTRACTANT TREATMENT SYSTEM	1,683,715
VI.	SEDIMENT REDEPOSITION	352,641
VII.	OFF-SITE HAZARDOUS DISPOSAL	1,967,755
VIII.	PROCESS PIPING AND I&C	163,800
IX.	ELECTRICAL	373,400
X.	BUILDINGS, PLATFORMS AND STAIRS	268,400
XI.	FOUNDATIONS AND PADS	182,300
	TOTAL DIRECT CONSTRUCTION COST (TDCC)	7,478,424
	CONTINGENCY @ 20% OF TDCC	1,495,685
	ENGINEERING @ 5% OF TDCC	373,921
	LEGAL AND ADMINISTRATIVE @ 2% OF TDCC	149,568
	TOTAL CONSTRUCTION COST	9,497,598

OPERATION AND MAINTENANCE COSTS

SHORT-TERM	1,808,043
LONG-TERM	13,020

PRESENT WORTH COST (Calculated at a 5% discount rate)	12,941,849

RESPONSIVENESS SUMMARY

Vineland Chemical Company Site

Vineland, New Jersey

This responsiveness summary, as required by Superfund policy, provides a summary of citizen's comments and concerns received during the public comment period following the release of the RI and FS reports and the Proposed Plan. The public comment period was held for 30 days, from July 1, 1989 through August 1, 1989.

The RI and FS reports, and the Proposed Plan, can be found at one of the information repositories listed below:

Vineland City Hall
7th and Wood Streets
Vineland, NJ 08360
(609) 794-4060

Vineland Public Library
1058 East Landis Avenue
Vineland, NJ 08360
Reference Director:
Mr. Anthony Agnesino
(609) 794-4244

Millville City Hall
1800 South High Street
P.O. Box 609
Millville, NJ 08332
(609) 825-7000

Millville Public Library
210 Buck Street
Millville, NJ 08360
Reference Director:
Nancy Forester
(609) 825-7087

The EPA held a public meeting on July 18, 1989 at the Vineland City Hall to outline the remedial alternatives presented in the FS reports and to present EPA's proposed plan to clean up the Vineland Chemical Company Site. The EPA also conducted a public availability session on July 19, 1989 to allow concerned citizens an opportunity to discuss issues related to the site on a one on one basis with EPA.

The comments received during this interfacing with the public, written comments received from the public, and written comments received from the Vineland Chemical Company are summarized in this Responsiveness Summary. EPA's responses to these comments are also provided.

There are four appendices attached to this document: the Proposed Plan; EPA community relations activities at this site to date; sign-in sheets from the public meeting and public availability session; and the comments received from the Vineland Chemical Company to the RI/FS reports and the Proposed Plan.

Background on Community Involvement and Concerns

There was a high level of community concern regarding the Vineland Chemical Company site in 1980, following the closure of Union Lake to fishing and swimming. The closing was the result of high arsenic levels detected in the lake by the NJDEP. The decision was reevaluated, and the ban was lifted by the 1981 recreational season. In June 1984, a citizens' group called Watch Toxic Effluent Residues (WATER) requested and obtained a Vineland City Council resolution demanding action on all of the Cumberland County Hazardous Waste sites. The resolution was sent to EPA's Region II Regional Administrator.

In May, 1986, members of a statewide environmental coalition, the New Jersey Environmental Federation, organized a protest on the steps of Vineland City Hall. Local members of WATER, which is a member organization of the coalition, also attended the rally. The event was organized to focus attention on a public hearing that citizens scheduled for June regarding the Vineland Chemical Company's requests for operating permits from the NJDEP for its arsenic removal system to treat discharge water. The organization presented two goals:

- Initiate immediate actions to clean up the Vineland Chemical Company site; and
- Provide stricter enforcement to prevent further contamination.

In June, 1986, the NJDEP held a public hearing on the proposed denials of NJPDES and RCRA permits at the Vineland Chemical Company plant. Later that month, the EPA sent an informational letter to Vineland residents explaining the agency's involvement with the site.

In December, 1986, the EPA held a public meeting in the Vineland City Hall to present the agency's work plan for the RI/FS activities which would be conducted for the site. The public was generally pleased that the investigation was going to proceed.

The primary concerns citizens have raised about the site include:

- Perceived cleanup delays of the Vineland Chemical Company plant site and affected waterways.
- Potential contamination of the Cohansey aquifer and several private wells resulting from contaminated groundwater spreading to nearby residential areas.
- Potential closing of waterways, which would prohibit residents from using them for boating, fishing, and swimming.
- Potential health risks associated with exposure to contaminated groundwater and soils.
- Continuation of the Vineland Chemical Company's

operations. Residents would like to see severe penalties assessed to the company, commensurate with the perceived regulatory noncompliances.

- Lack of information from government officials to the community.

Summary of Major Questions and Comments Received During the Public Comment Period and EPA Responses to these Comments

Comments raised during the public comment period and during the public meeting and public availability session are summarized below. The public comments and responses are organized into five categories: Technical Questions/Concerns Regarding Remedial Alternatives; Recreation; Health Risk Assessment; Costs/Funding Issues; and Enforcement. The comments received from the Vineland Chemical Company are presented as an appendix to this document, with EPA responses to these comments presented as the last part of this section.

A. TECHNICAL QUESTIONS/CONCERNS REGARDING REMEDIAL ALTERNATIVES

Comment: A resident asked why EPA was using methods that required waste removal, rather than in situ vitrification which would turn the waste into a glass. The resident later presented EPA with the name of a company that the resident knew was engaged in marketing the in situ vitrification technology, and suggested that the EPA contact this company for more information.

EPA's Contractor Response: EPA has evaluated a number of treatment technologies, but in situ vitrification was screened out at an early stage in the Feasibility Study because it was considered less cost-effective than other methods.

Comment: As part of their Proposed Plan, EPA said that they would allow the Maurice River to flush for a period of three years to allow the contaminants an opportunity to flush naturally. The three year waiting period would begin after the Remedial Design is completed. A resident asked if EPA could extend the three year waiting period, or start it after cleanup in the Blackwater Branch is finished. This would allow sediment suspension to be reduced and give the Maurice River ample time to naturally flush itself.

EPA's Response: EPA responded that the Proposed Plan was designed to minimize sediment suspension in the Maurice River. A dredge is proposed which would minimize sediment resuspension. The amount of sediment suspension would be controlled by adjusting the amount of water and sediment in the dredge. If this method cannot be used, then silt curtains would be placed downstream to catch suspended sediments.

EPA expressed confidence that by cutting off the source of the arsenic contamination that is currently leaving the plant site via the Blackwater Branch, natural cleansing mechanisms in the Maurice River would reduce the arsenic level.

Comment: A resident commented that a higher level of remediation should occur on the west side of the lake because it recently came under state ownership and has become more accessible to the public.

EPA Response: EPA replied that it would consider this concern as well as any other additional information on the use of the west side of the lake before making a final determination on the remediation to be conducted.

Comment: A resident asked if there were any differences between the level of contamination at the West Side Park (which was capped with sand ten years ago) and other sites along the river.

EPA Response: EPA confirmed that the level of arsenic contamination located near West Side Park was found to be lower than the levels found in the rest of the river.

Comment: A resident asked if EPA will be digging up the asphalt at the site.

EPA Response: EPA said that they would be looking at the soil under the asphalt during the design phase. As part of the design, further sampling will be conducted to further characterize the contamination at the site.

Comment: A resident asked how EPA would know that the contamination is cleaned up and that there are no other pollutants affecting the area.

EPA's Contractor Response: EPA replied that it would conduct ongoing monitoring after completion of the remedial action to ensure that the Vineland Chemical Company Site has been cleaned satisfactorily. The ongoing monitoring will be conducted, at a minimum, in five year intervals for the next 30 years.

B. RECREATION

Comment: Several residents commented that they would prefer that EPA let the river flush itself naturally rather than dredging it. They feel that dredging would cause ecological and aesthetic damage.

EPA Response: EPA recognizes the community's concern about the potential ecological effects of dredging on the Maurice River and Union Lake. As part of EPA's Proposed Plan, an environmental assessment would be conducted during the Remedial Design phase to evaluate the effects of dredging on the ecosystem if it is determined to be necessary. EPA expressed its preference that the river would flush itself naturally.

Comment: A resident asked if EPA will reopen the lake for recreational use after the dam is completed.

New Jersey Department of Environmental Protections's (NJDEP) Response: NJDEP replied that the completion of the new dam at the lake should be finished by the fall of 1989 at which time the lake would be reopened for fishing and boating. Additionally, NJDEP will take sediment samples to see if the lake would be safe for swimming in the summer of 1990.

Comment: A resident asked if EPA could conduct the remediation when the lake is full so that residents could use the lake for recreational purposes.

EPA Response: EPA expressed confidence that a much better cleanup of Union Lake could be conducted when the lake water level is lowered. With the lake at the lower level, contaminated areas can be located more easily, cleanup conducted much more efficiently, and material from the cleanup redeposited more quickly. If cleanup is done with the lake at its full condition, EPA expressed fear that a few "hot" spots might be missed.

However, if new technology becomes available that would make it more feasible to do the cleanup with the lake at its full condition, then EPA said it would consider it.

C. HEALTH RISK ASSESSMENT

Comment: A resident asked why the waterways had to be cleaned up since they are not used as a drinking water source.

EPA Response: EPA responded that the decision to clean up the Vineland Chemical Site, Blackwater Branch, Maurice River and Union Lake was based on a Risk Assessment. The Risk Assessment looked at the concentrations of the arsenic in the sediments and made a determination of how often people would come in contact with the arsenic. A Risk Assessment is a conservative tool to ensure the community's safety. In this case, the waterways were found to be a potential risk for residents who might use them for recreation.

Comment: Several residents said that they would like to see studies that compare the health of people living near the contaminated waterways with the health of those who do not.

EPA Response: EPA recognized the residents' concern and said that they will discuss it with the New Jersey Department of Health.

Comment: A resident asked if there have been any studies done on the health of workers at Vineland Chemical Company.

EPA's Contractor Response: EPA's contractor stated that in the early 1980's the New Jersey Department of Health did a survey of the workers at the Vineland Chemical Company and found they had elevated levels of arsenic in their system. One employee exhibited minor symptoms of arsenic poisoning, and as a result, NJDEP ordered changes in the plant's operating procedures.

Comment: Several residents expressed concern over discolored drinking water upstream from the site.

EPA Response: During the remedial investigation, EPA said that it did not find elevated levels of arsenic in the soil or water upstream from the Vineland Chemical Company plant. However, EPA indicated that it will do further investigation during remedial design.

Comment: Several residents asked why EPA chose the arsenic cleanup level of 20 milligrams of arsenic per kilogram of sediment (mg/kg) for the river and lake.

EPA Response: EPA replied that its Proposed Plan consists of cleaning the river and lake sediments to 120 mg/kg, but this level is reduced to 20 mg/kg in more accessible areas such as Almond Beach, the Blackwater Branch floodplain, Union Lake beach, the Sailing and Tennis Club beach, and residential areas. After studying these areas, EPA had found that many people use the river and lake for swimming, wading, fishing and boating. While intentional ingestion of water and sediment during these activities was unlikely, people, especially children, may contact contaminated soil/stream sediment while eating, playing, or swimming. For that reason, EPA proposes to use the action level of 20 mg/kg arsenic when cleaning accessible areas of the river and lake.

D. COSTS/FUNDING ISSUES

Comment: A resident asked who was going to pay for the site cleanup.

EPA Response: EPA replied that it has already set aside money in their budget to pay for the studies conducted to date and the remedial design. However, through administrative and legal actions, the Enforcement Branch of EPA will try, if possible, to recover the costs of both the study and cleanup from any potentially responsible parties (PRPs).

Comment: A resident asked if the cost of the proposed remedial program reflected the cost after a ten year period of inflation.

EPA Response: EPA said that the costs shown in the Feasibility Study and the Proposed Plan represent present worth. Present worth is the amount of money EPA would have to invest now in order to have the appropriate funds available at the actual time the remedial action is implemented, assuming that the money invested now earned interest at 5% above the inflation rate.

Comment: A resident inquired as to whether the EPA had received bids from contractors for the cleanup, or whether the proposed budget was an estimate.

EPA Response: EPA explained that the proposed budget was an estimate for a relative evaluation of cost; therefore, the actual cost could be 30% less or 50% more than the cost presented.

E. ENFORCEMENT

Comment: A resident inquired whether Vineland Chemical Company is still dumping arsenic into the Blackwater Branch.

NJDEP Response: NJDEP replied that a small amount of arsenic is still being released in the effluent discharge emanating from the site. However, the majority of contamination coming off the site into the Blackwater Branch is through the contaminated groundwater. Vineland Chemical is allowed a small amount of effluent discharge into the Blackwater Branch, however, this discharge contains arsenic at allowable levels. Activities at the Vineland Chemical Company Plant are being closely monitored by the state.

F. REMAINING CONCERNS

One remaining concern voiced by residents was the possible dredging of the Maurice River and Union Lake. The residents expressed opposition to the proposed dredging because of its potential ecological and aesthetic damage. Residents have requested the opportunity to participate in the final decision-making on the dredging issue.

Comment: A resident asked if EPA would hold another public meeting prior to initiating any dredging of the Maurice River or Union Lake.

EPA Response: EPA responded that as part of EPA's ongoing Community Relations program, EPA will continue to keep residents informed of site activities. This will include a fact sheet and press release after the Record of Decision is signed. The Community Relations Plan will be revised during the design phase and a fact sheet and public meeting will be held prior to initiating the remedial action.

July 31, 1989

Received
8/3/89
fcc

Dr. Ferdinand Cataneo
EPA Rm. 759
26 Federal Plaza
New York, NY 10278

Dear Sir:

I believe that the proposed "cleanup" of the Vineland Chemical site is unnecessary and will create many more problems than it will solve.

In the current hysteria over soil pollution by arsenicals, no one seems to mention that arsenic in native form or as its salts (eg. scorodite, proustite etc) is found widely distributed in nature.

Moreover arsenicals have been used extensively and successfully in medicine over the centuries in dosages many orders of magnitude greater than those contemplated today in the worse case (i.e. consuming the sediment of Union Lake!). Surely Professor Ehrlich, inventor of arsphenamine (salvarsan) the first disease-specific medicine, must be turning over in his grave!

Lastly dredging Union Lake for such a quixotic project is financially wasteful at best and destructive of the environment at worse. EPA has done enough to destroy the small businessman in America. Let us for once listen to the voice of reason instead of those that are after the quick buck and the election vote.

Sincerely yours,

George Inglessis, Ph.D.
P.O. Box 2310
Vineland, NJ 08360

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION II
JACOB K. JAVITS FEDERAL BUILDING
NEW YORK, NEW YORK 10278

September 27, 1989

Mr. George Inglessis, Ph.D
P.O. Box 2310
Vineland, New Jersey 08360

Dear Mr. Inglessis:

This is in response to your July 31, 1989 letter regarding the Vineland Chemical Company Superfund site, which includes the plant site, the Maurice River areas, and Union Lake.

In your letter, you express concern that the cleanup covered by the Proposed Plan is unnecessary and could harm the environment. You also indicate that arsenic is common in nature and has been used medicinally.

Regarding the need for the cleanup, the remedial investigation and feasibility study (RI/FS) shows that the cleanup is necessary to mitigate the long-term threat to public health and the environment caused by arsenic contamination. The decision by the U.S. Environmental Protection Agency (EPA) to remediate is based on a risk assessment.

A risk assessment involves determining possible routes of human exposure to contaminated media (air, water, soil) at a site, then estimating possible intake levels. Contaminants within those media are determined. The toxicological properties of those contaminants are then evaluated. Finally, semi-quantitative estimates of potential health risks are determined using the potential routes of exposure, contaminants of concern and their intake levels, and the toxicological properties of those contaminants.

Arsenic compounds are carcinogens. The risk assessment shows that lifetime exposure to contaminated site soils, or sediments in the impacted water bodies, is associated with unacceptably high excess lifetime cancer risks.

Your observation that certain arsenicals have been used as medicines is correct. However, the carcinogenic potential of long-term exposure to arsenic compounds is relatively new knowledge.

Although arsenic is widely distributed in nature, it is generally found at concentrations much lower than those in the media requiring remediation at the Vineland Chemical site.

EPA acknowledges that the proposed remedial activities could cause environmental damage. In this regard, as described in the RI/FS, steps would be taken during remedial design to avoid or minimize damage to the environment or to historic cultural resources.

Please write to me at the following address if you have any further comments or questions concerning the Vineland Chemical Company site:

U.S. Environmental Protection Agency
26 Federal Plaza
Room 711
New York, New York 10278

Sincerely yours,

Ferdinand C. Cataneo

Ferdinand Cataneo, Project Manager
Southern New Jersey Remedial Action Section

J. H. CRESSON
FORTY EAST SECOND STREET
MOORESTOWN, N. J. 08057

Dr.Ferdinand Cataneo
Project Manager
U.S. Environmental Protection Agency
Room 759, 26 Federal Plaza
New York, N.Y. 10278

7/24/89

Received 8/3/89
JOC

re: Proposed Cleanup Alternatives for Vineland Chemical Site

Dear Dr. Cataneo,

As a member of the archaeological community here in southern N.J. for more than 25 years I am extremely concerncd for the known, as well as, unknown archaeological resources that will surely be threatened if not impacted in the course of the Maurice River and Union Lake cleanup program.
Having worked in this region of the state for more than 10 years its without question clear that very significant cultural resources (prehistoric and historic) lie adjancent, along and under the waters from the upper tributaries of Blackwater Branch to the Union Lake empoundment. Also, beyond this critical point, down to the bay archaeological resources have been well documented along both banks.

No matter which alternatives are chosen (with the exception of No Action) regionally significant cultural resources will be at risk unless appropriate safeguards are implemented to protect in place or mitigate impacted resources.

Your attention to this serious situation is greatly appreciated.

Jack Cresson

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION II
JACOB K. JAVITS FEDERAL BUILDING
NEW YORK, NEW YORK 10278

September 27, 1989

Mr. Jack Crosson
40 East Second Street
Moorestown, New Jersey 08057

Dear Mr. Crosson:

This is in response to your July 24, 1989 letter concerning the Vineland Chemical Company Superfund site.

We share your concern for the cultural resources located in and near the Maurice River and Union Lake. The U.S. Environmental Protection Agency (EPA) is aware that these resources may exist and will conduct a Stage 1A Survey for cultural resources during remedial design. This will allow EPA to take steps to preserve the prehistoric and historic cultural resources of the waterways during remedial activities.

If you have any further comments or questions, please write to me at the following address:

U.S. Environmental Protection Agency
26 Federal Plaza
Room 711
New York, New York 10278

Sincerely yours,

Ferd C. Cataneo

Ferdinand Cataneo, Project Manager
Southern New Jersey Remedial Action Section

R. D. #2, Port Cumberland Rd.
Millville, NJ 08332
July 26, 1989

Received
7/31/89

Dr. Ferdinand Cataneo
Project Manager
U.S. Environmental Protection Agency
N. J. Remedial Action Branch
26 Federal Plaza, Room 759
New York, NY 10278

Dear Dr. Cataneo,

I am writing to you regarding the proposed cleanup of Union Lake, which has been systematically polluted by the Vineland Chemical Company over a period of decades. Like many residents of the Millville area, I grew up swimming and boating on Union Lake, as did my mother and her father before her. The Lake's importance , therefore, surpasses that of a recreational facility and is part of our heritage.

Since my first years around the Lake (approximately 25 years ago), I have observed numerous changes in the water, such as fewer turtles and snakes, while algea levels increased. As a personal note, I also experienced a contact dermatitis from the Lake in the last several years. Throughout this time, the conventional wisdom has held that these changes were symptoms of the pollution from the Vineland Chemical Company.

Our region of the state is poor , both in human and financial resources. However, the area of the Lake, the Maurice River, the Manumuskin River, and the Menantico River are all treasures. We need a strong governmental agency to help us protect these irreplaceable jewels, both for our human population and the wide variety of rare flora and fauna found here.

I cannot state emphatically enough to you my anger that the Vineland Chemical Company's violation of this area was allowed to continue for so many years - even after your agency was aware of it. The Company's persistance in this desecration discredits any governmental claims to protect our environment.

I am, however, most gratified that action is finally being considered which can rectify, at least to the extent possible, this situation. As I told representatives of the EPA at a recent hearing in Vineland, I have no expertise with which to form an opinion about the cleanup alternatives.

Instead, my purpose in writing to you is to urge that the Lake be rendered useable and that our region in general be protected from forces that threaten our fragile environment. For example, Atlantic Electric Company is building a station at the edge of Maurice River Township, near what may be the state's only pristine water: in 25 years, will I be writing to you about that? Truly, we need your agency's support there, as well. I hope you can help us in the fight to preserve our area.

Sincerely,

Christine Ward Garrison

Christine Ward Garrison, Ph.D.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION II
JACOB K. JAVITS FEDERAL BUILDING
NEW YORK, NEW YORK 10278

September 27, 1989

Ms. Christine Ward Garrison, Ph.D
R.D. #2, Port Cumberland Road
Millville, NJ 08332

Dear Ms. Garrison:

This is in response to your letter of July 26, 1989, concerning the Vineland Chemical Company Superfund site.

In your letter you ask that Union Lake "be rendered usable" and that the Maurice River system be protected from further environmental damage.

We share your concern for the environmental quality of the Maurice River and Union Lake. The actions included in the U.S. Environmental Protection Agency's (EPA) Proposed Plan to remediate the Vineland Chemical Co. plant site will halt the flow of arsenic-contaminated groundwater to the Blackwater Branch and, thereby, begin the river system's restoration.

Remediation of the heavily contaminated floodplain and sediments of the Blackwater Branch will follow. During the clean up of the Blackwater Branch and subsequent clean up of the Maurice River and Union Lake, as necessary, EPA will take all required steps to protect the quality and ecology of those water bodies.

In the short term, any discharges from the Vineland Chemical plant will continue to be monitored by the New Jersey Department of Environmental Protection (NJDEP). Further, Union Lake will be opened for boating and fishing sometime this fall after the lake water level returns to normal, as recently announced by NJDEP.

Finally, we understand that sections of the Maurice River south of Union Lake to the Delaware Bay, and its Menantico Creek and Manumuskin River tributaries, are eligible for Scenic and Recreational status, according to a June 1988 report [illegible] the National Park Service. If they are eventually placed in the National Wild and Scenic Rivers System, they will be permanently protected for the benefit and enjoyment of the people.

If you have any further comments or questions concerning the Vineland Chemical Company site, please write to me at the following address:

U.S. Environmental Protection Agency
26 Federal Plaza
Room 711
New York, New York 10278

Sincerely yours,

Ferdinand C. Cataneo

Ferdinand Cataneo, Project Manager
Southern New Jersey Remdial Action Section

Merrill Lynch Consumer Markets
200 West Lancaster Avenue
Wayne, Pennsylvania 19087
215 687 7918
800 235 3922 In State
800 523 2755 Out of State

Received 7/21/89
FCC

Merrill Lynch

Helen B. McHenry
Assistant Vice President

July 18,1989.

Dr. Ferdinand Cataneo
Project Manager, USEPA
Rm 759, 26 Federal Plaza
New York, N.Y. 10278

Dear Dr. Cataneo:

I read with interest the proposed clean up of the bottom of Union Lake in Millville, New Jersey. Please proceed with haste.

My parents have owned a water- front property at Union Lake since 1944 and I have enjoyed many years of swimming, sailing and fishing (I eat what I catch).

During the 1950s we noticed scum streaks and detergent buildup on the beaches in addition to an unlovely algae bloom in August in the dry summers. My father, retired from his legal practice to live at the lake, repeatedly approached the N.J. EPA about the scum and often foul smelling water emerging from the rivermouth at the head of the lake. (His favorite fishing spot for largemouth bass was at the gatehole across from the Union House now owned and occupied by George Woods.)

The City of Vineland operates a sewage treatment facility near the junction of Blackwater creek and the Maurice River very close to the bridge at Sherman Avenue. As a child, my family often canoed up the river on a hot summer day to swim in the cold water of the little stream with the clear sand bottom. Several summers ago, the year before the lake was drained, my son and I made a sentimental journey, complete with picnic basket, up the river to swim and enjoy the cold water. The river was blocked with several large trees but we were able to portage. 300 yards downstream of the bridge we notice the odor of untreated sewage. Angry and curious, we paddled to the bridge and the little creek and saw brown foul smelling water emerging from the little creek. The clear sand was brown and many dead trees were on the bank. Shreds of paper and assorted debris floated by our canoe.

Upon returning to my Mother's home, I spoke with her neighbor, State Representative Hurley and asked him to travel up the stream to see the mess. Shortly thereafter, I returned to my home.

My family has watched the delay in the rebuilding of the dam. We are anxious for the return of the lake. However, clean water is of paramount importance to me. On several occassions when I have travelled on Route 55 to Millville, I have lowered my windows to do a " sniff" check of the sewer facility. Bad odors and dead trees proliferate in the area near the bridge at Sherman Avenue which was still a mess this early summer.

Please, while you are doing your dredging of the bottom of the lake, do a bacteriophagic test on the Blackwater branch and the area surrounding that sewage treatment plant.

Sceptics have stated that the lake will never be cleaned up and that it is not important. If a city like San Diego can produce clean water from a sewage treatment plant, the City of Vineland can learn from them. The EPA will have to insist that all dumping from any and all sewage treatment plants be stopped.

Please call me at my home on 215 649 8398 should you need further information. Please believe that in the group of hostile property owners you do have some friends.

Sincerely:

Helen Borz McHenry Giberson

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION II
JACOB K. JAVITS FEDERAL BUILDING
NEW YORK, NEW YORK 10278

September 27, 1989

Ms. Helen Borz McHenry Giberson
200 West Lancaster Avenue
Wayne, Pennsylvania 10087

Dear Ms. Giberson:

This is in response to your letter of July 18, 1989 concerning the Maurice River and Union Lake portions of the Vineland Chemical Company Superfund site.

In your letter, you ask that the proposed clean-up of Union Lake proceed with haste. You also express concerns about observations associated with the effects of local sewage treatment plant effluents on the Maurice River and Union Lake.

The Proposed Plan by the U.S. Environmental Protection Agency to clean up the arsenic contamination at the Vineland Chemical site will be implemented as expeditiously as possible.

However, problems related to your concerns about the effects of the sewage treatment plant effluents on the Maurice River and Union Lake are outside the scope of the Superfund cleanup and are best handled on a local, State or city level.

If you have any further comments or questions concerning the Vineland Chemical Company Superfund site, please write to me at the following address:

U.S. Environmental Protection Agency
26 Federal Plaza
Room 711
New York, New York 10278

Sincerely yours,

Ferdinand C. Cataneo

Ferdinand Cataneo, Project Manager
Southern New Jersey Remedial Action Section

Received 7/21/89
FCC

CUMBERLAND CONSERVATION LEAGUE
210 N. HIGH ST. MILLVILLE, N. J. 08332

July 18, 1989

Dr. Ferdnand Cataneo, Project Manager
U. S. Environmental Protection Agency
N. J. Remedial Action Branch
26 Federal Plaza, Room 711
New York, N. Y. 10278

Re: Vineland Chemical Co. Superfund site

Dear Dr. Cataneo:

The Cumberland Conservation League is a group of approximately 150 members formed in 1974 to preserve and protect the natural resources of Cumberland County.

We are particularly concerned that none of the remedial action proposed includes the closing of the Vineland Chemical Co. In the Daily Journal article, "Union Lake: Arsenic and laced" on July 12, 1989; it was reported that 500 metric tons of arsenic have flowed from VinChem since 1949. According to the 1980 census there were about 132,000 people in the county which gives each and every person in the county a "share" of about 8.3 pounds of arsenic.

And, that "approximately 150 [metric] tons of arsenic was bound to Union Lake's sediments." If we look at this figure in the same way, each Millville resident's share (based on a population of 25,000) is 13.2 pounds of arsenic.

The plant is still in operation even though the DEP began monitoring in 1966 and has over the years fought legal battles to force the company to comply with regulations. Vineland Chemical has shown a flagrant disregard for the health and safety of the residents of Vineland, Millville, Commercial and

Maurice River Townships. There is no reason to believe that as they continue operation they will operate in any manner other than their past actions indicate.

Of primary importance is the closing of this plant and the cleaning of the 54 acre plant site. This should include removing arsenic from groundwater at the site to keep it from seeping into the Blackwater Branch of the Maurice River. At that time a thoughtful reassessment should be conducted to determine if further draining, dredging or excavating of arsenic laden "hot spots" down the river would be advisable. It is possible that some delicate ecological areas could be damaged more by the clean-up than by the arsenic itself.

Above and below Union Lake the following plants are either listed as threatened (LT) or are being reviewed for inclusion by the federal government (C2).

Swamp Pink	Helonias Bullata	LT
Curly-grass Fern	Schizaea Pusilla	C2
New Jersey Rush	Juncus Caesariensis	C2
Torrey's Muhly	Muhlenbergia Torreyana	C2
Resinous Boneset	Eupatorium Resinosum	C2
Parker's Pipewort	Eriocaulon Parkeri	C2

It is important not only to remove the arsenic risk from these sites, but to not cause further damage through clean-up efforts.

Sincerely,

Diann Ewan

Diann Ewan, Secretary

cc: Mayor James Parent, Millville
Mayor Harry Curley, Vineland
Vineland Health Dept.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION II
JACOB K. JAVITS FEDERAL BUILDING
NEW YORK, NEW YORK 10278

September 27, 1989

Ms. Diann Ewan
Secretary
Cumberland Conservation League
210 North High Street
Millville, New Jersey 08332

Dear Ms. Ewan:

This is in response to your July 18, 1989 letter concerning the Vineland Chemical Company Superfund site.

In your letter you raise two issues. First, you are concerned because the proposed remedial actions do not include closing of the Vineland Chemical Company which you feel would stop arsenic flow from the site. Second, you express concern that the cleanup of arsenic contamination in the river could cause environmental damage.

Regarding the first issue, the forced closing and/or regulation of operating facilities is outside the scope of a Superfund cleanup. However, effluents from the Vineland Chemical plant site are being monitored by the New Jersey Department of Environmental Protection, so that arsenic release is minimized, except for the arsenic in groundwater flowing from the site to the Blackwater Branch. The groundwater flow will be stopped when groundwater remediation begins.

On the second issue, the U.S. Environmental Protection Agency shares your concern that further damage to the environment which could occur during cleanup efforts should be minimized. This concern is demonstrated in the Proposed Plan which seeks to minimize the need for dredging.

The plan allows the Maurice River time to flush itself clean after the flow of arsenic contaminated groundwater to the Blackwater Branch is stopped. During a three year flushing test period, the natural cleansing performance of the river would be assessed through sampling studies. If the testing shows that the river's natural cleansing is adequate or that such cleansing could be accomplished within a reasonable additional time period, no dredging would be needed. However, should the testing suggest remediation, any dredging required would be subject to an

Environmental Assessment of its effects on the Maurice River ecology including downstream contamination. In addition, a field survey would be done to comply with the Endangered Species Act, and a Stage 1A survey would be done to ensure that important historic cultural resources are identified and preserved.

Remediation of Union Lake under the Proposed Plan would be accomplished largely through excavation after the lake water level is lowered, thereby avoiding dredging. Any remediation of Union Lake would be subject to an Environmental Assessment as for the Maurice River.

If you have any further comments or questions concerning the Vineland Chemical site, please send them to me at the following address:

U.S. Environmental Protection Agency
26 Federal Plaza
Room 711
New York, New York 10278

Sincerely yours,

Ferdinand C. Cataneo

Ferdinand Cataneo, Project Manager
Southern New Jersey Remedial Action Section

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION II
JACOB K. JAVITS FEDERAL BUILDING
NEW YORK, NEW YORK 10278

SEP 29 1989

Mr. Franklin J. Riesenburger
Greenblatt & Riesenburger
200 North Eighth Street
Vineland, New Jersey 08360-00883

Dear Mr. Riesenburger:

This is in response to your letter of July 31, 1989 which contains comments on the Remedial Investigation and Feasibility Study (RI/FS) on the Vineland Chemical Company Superfund site. Your letter is included in the Record of Decision as Appendix D, and responses to the comments are presented below.

Page 1, Para.1 and 2

A public comment period of no less than 21 days for reviewing RI/FS reports and the proposed plan is required by the Comprehensive Environmental Response, Compensation and Liability Act and the National Contingency Plan. This period was extended to 30 days for the Vineland Chemical Company site.

Page 2, Para. 1

The examples of "technical deficiencies" are primarily editorial in nature and have little or no impact on the results of the RI/FS.

Page 2, Para 2 through Page 3, Para 2

These two pages present a summary of a previous legal case between the Vineland Chemical Company and NJDEP. The EPA has no comment on the proceedings of this case.

Page 3, Para 3 through Page 4, Para 1

The ATSDR was asked by EPA to assess the potential public health issues relating to the drawdown of Union Lake's water level which was planned as a part of the Union Lake dam rehabilitation project. The two conclusions of their assessment are repeated below:

1) ATSDR evaluated the above chemicals of concern [arsenic] in relationship to possible pathways of exposure and concludes that there is not a significant

public health threat associated with the lowering of the water level at Union Lake.

2) The source of arsenic contamination should be addressed to prevent further contamination.

These two conclusions are entirely consistent with the results of the RI/FS, and do not contradict the RI/FS as the comment suggests.

The first conclusion is that there are no increased health risks from the lake at its lowered water level condition. The risk assessment in the Union Lake RI report reached the same conclusion, stating that there was no increased health risk from the lake being at its lowered water level for a short period of time ranging from three to five years. However, the risk assessment in the RI report also evaluated risks from 70 years of exposure to the lake, and determined that there were indeed increased potential health risks from this long-term exposure. The ATSDR report did not consider these long-term exposure risks, only the risks from the lowered water level condition.

The second conclusion, that the source of arsenic contamination into the lake should be addressed to prevent further contamination, is the focus of the RI/FS reports and the proposed remediation plan. The remediation plan addresses the contamination caused by the Vineland Chemical Company.

Page 4, Para. 2:

On the issue of potential health risks, the risks calculated from human exposure to the soils, groundwater, surface water, and sediment within the Vineland Chemical Company site are presented in the RI reports. These risks were calculated using EPA approved methods for determining potential health risks at Superfund sites.

Page 4, Para. 3 through Page 6, Para. 2

Several points were raised in these paragraphs. The major points are addressed below.

a) Every tributary to the Maurice River between the Blackwater Branch and Union Lake was sampled in the RI/FS. The samples were obtained as close to the confluence between the tributaries and the Maurice River as possible to be able to determine the input of arsenic into the basin from all sources.

The comment is misleading since it alleges that samples were not taken from the Tarkiln Branch, and does not acknowledge that samples were taken from the Parvin Branch. The Parvin Branch and the Tarkiln Branch are the same stream. The stream is named the Tarkiln Branch to the east (upstream) of Orchard Road and is named the Parvin Branch to the west (downstream) of Orchard Road. Both names apply to the same body of water.

Surface water and sediment samples were obtained from the Parvin Branch (downstream of the alleged source in this comment) in Phase I in 1986 and in Phase II in 1987. The sampling results are presented in the River Areas RI report. The results showed that the sediment and surface water had low to undetected arsenic concentrations. If the alleged previous source did exist, evidence of its existence was not present in the form of elevated arsenic concentrations in the downstream surface waters and sediments. This was clearly not the case with the surface waters and sediments downstream from the Vineland Chemical Company site, which showed elevated arsenic concentrations.

b) The River Areas RI report presented a discussion that an estimated 500 metric tons of arsenic had been released into the Maurice River drainage basin through time. This estimate was based on data obtained by the Vineland Chemical company that was presented in its RCRA Part B permit application. This data was obtained in the Blackwater Branch immediately downstream from the Vineland Chemical Company Site, and was cross-checked with data collected by USGS at its stream gaging station on the Maurice River at Norma, downstream of the Blackwater Branch.
Considering the above, the alleged presence of another source of arsenic into the basin (which was not detected downstream of this alleged source) would in no way alter the estimate of 500 metric tons of arsenic being released from the Vineland Chemical Company site through time. This estimate was based on data obtained by the Vineland Chemical Company well upstream of the alleged other source of arsenic.

c) The EPA was not afforded an opportunity to observe the sampling allegedly performed by the Vineland Chemical Company in the Tarkiln Branch, although the Vineland Chemical Company was afforded an opportunity to observe all EPA sampling in Phase II and declined. The data presented by the Vineland Chemical Company are not verified by independent data. This is in contrast to the data submitted by the Vineland Chemical Company that was used to estimate the release of arsenic from the site which could be verified by other data including the EPA's data from this RI/FS.

d) Finally, the NJDEP does not certify any laboratory to perform arsenic sampling, including the Vineland Chemical Company's laboratory. Certification may be granted for analysis only.

Page 6, Para 3 through Page 7, Para 2

Low to undetected arsenic concentrations were found in the EPA sampling stations downstream from this alleged source.

Page 7, Item (A)

No arsenic was detected at the sampling points downstream of this alleged source, whether it existed or not.

Page 7, Item (B)

Since the Parvin/Tarkiln Branch is not downstream of the Vineland Chemical Company site, it is not within the area of contamination caused by the site. As such, it is not under consideration in the Vineland Chemical Company site cleanup plan.

Page 7, Item (C)

The form of arsenic in Union Lake cannot be used to trace the form in which the arsenic was when it was released into the environment. This is because arsenic in the lake is involved in the biological cycle and is converted readily between organic and inorganic forms, as discussed in the RI reports. The form of arsenic in the lake is a function of the time of year and the phase of the biological cycle at the time of sampling. It is not a function of the form in which the arsenic was when released into the environment.

The EPA has no basis for believing that there is or has been another source of arsenic into the Maurice River Basin.

Page 7, Item (D)

(a) The fact that speciation tests cannot be used to trace a source is discussed above. There is no evidence to indicate that there is another source of arsenic into the basin.

(b) The EP Toxicity test for arsenic is not used to determine whether or not an area requires remediation. The decision to remediate is based on the risk assessment and other environmental factors. The EP Toxicity "characteristic" test may be used in conjunction with other factors to determine the method of final disposal of the remediated sediments. It is not used to determine the need for remediation. The sediments in Union Lake are within the areal extent of contamination caused by the Vineland Chemical Company Superfund site. Thus they may be considered when evaluating remedial strategies for this site.

Page 8, Item (E)

The inability to use the form of arsenic in the lake as a tracer of the source of arsenic has been discussed in previous responses.

Page 8, Item (F)

The EPA's preference for remedial actions in the lake is based on health based concerns which were evaluated through a risk assessment. The use of the word hazardous in this comment is misleading. This word refers to a waste classification for disposal only. This does not determine whether a site requires remediation. The need for remediation is determined by a risk assessment and other environmental factors.

Page 8, Item (G)

The Vineland Chemical Company was shown to be the only source of arsenic into the basin. The form of arsenic in Union Lake has been discussed in previous responses.

Page 9, Para. 1 (Item 3)

The cleanup goals for the sediments were set after considering the risk assessment results. The risk assessment was not constructed to yield a predetermined cleanup goal.

Page 9, Para. 2

There is no Page 3-8 in the Executive Summary of the Final Draft Feasibility Study Report for Union Lake. However, Page E-6 in the Executive Summary of this report does provide a summary of the findings of EPA Headquarters personnel relative to the classification of treated materials for disposal purposes. This classification has no association with the establishment of cleanup goals, rather it is considered when determining where to dispose of treated materials. Cleanup goals are set independently of this classification.

Page 9, Para. 3

The NJDEP's 20 ppm department guidance value for arsenic is explained in the FS reports and is identified as a "To Be Considered" guideline.

Page 9, Para.4

The sediment cleanup goal in Union Lake is 120 ppm in certain less accessible portions of the lake (corresponding to an increased cancer risk of 1x10(-5)), and is 20 ppm in certain more accessible portions of the lake (corresponding to a increased cancer risk of 2x10(-6)) to afford a greater degree of health protection. The risk assessment was not constructed to arrive at these levels, rather these levels resulted from the findings of the risk assessment.

Page 10, Para. 1

CERCLA mandates that state regulatory agencies be involved in the RI/FS process conducted by EPA under the Superfund program.

Page 10, Para. 3 (Item A)

The ATSDR report for Union Lake is in complete agreement with the RI/FS risk assessments in that no increased health risks were calculated for the lake being drawndown, as was discussed previously. The RI/FS risk assessments considered this scenario, as well as the scenario of long-term exposure to the lake. Long-term exposure was determined to pose increased potential health risks.

Page 10, Para. 4

The RI/FS reports never speak of the positive effects of "natural cleansing" of the Union Lake sediments, nor do the reports ever state that the amount of arsenic on the surface sediments will decrease through time through natural cleansing dynamics. On the contrary, the reports clearly identify the need to determine the rate of arsenic desorption from the sediments because the rate of desorption is unknown.

EPA recognizes that the distribution of contaminated sediments in the lake may change. EPA's intention to resample the sediments in the lake is clearly indicated in the RI/FS reports, the proposed plan, and the ROD. The need to resample the sediments, however, does not invalidate the risk assessment. Rather, with the risk assessment in place it will be far easier to determine the risks from the lake in the future. Since the exposure models have been developed, all that is required to evaluate the future risks in the lake, after resampling, is to incorporate the appropriate concentrations into the exposure models. The risks that are produced by various sediment arsenic concentrations will be known very quickly.

Page 11, Para. 2, 3, and 4 (First three Para of Item B)

The information requested by the comment (protocol, quality assurance/quality control documents and procedures, laboratory results, and chain of custody documents for the NJDEP's August 1986 sampling) is quite voluminous and is available for review by interested parties. This information is typically not provided within an RI/FS report simply because of its volume.

Page 11, Para. 5

The comment is misleading in that it takes statements designed to explain data validation in general out of context, and does not indicate the conclusion of the discussion that follows the statements. For completeness, the conclusion of the data validation discussion is presented below, as it appears on Page 4-12 of the Final Draft Union Lake RI Report.

> "Therefore, rather than lose some pertinent site data, these data have been appropriately footnoted and included within the report. Although rejected data were included in the report, no conclusions were based upon rejected data."

The reader is therefore clearly aware of the quality of the analytical results, and which analytical results were used when drawing conclusions about site contamination.

Page 12, Para. 1

The EPA believes that the two referenced analytical results (29 versus 107 ppm) are not at "highly unacceptable variances" as the comment alleges. Given the reasons outlined in the RI report, high matrix variability and the high arsenic levels in the lake sediment samples, these two results are not unacceptable and are in fact reasonable for the given conditions.

Page 12, Para. 2

The reasons for individual data rejections, or for non-rejections, has not been provided for any of the data obtained by Ebasco. This is due to the sheer volume of material which would have had to be presented. Both the Plant Site and River Areas RI reports note that this information was not provided in the reports for this reason, and indicate that this data is available for inspection.

Page 12, Para. 3 and 4 (Item C)

The statement that the data has not been appropriately plotted is misleading. The referenced results for stations EL-3 and EL-5 are plotted in their appropriate locations, as can be seen by reviewing Figure 4-1. The higher arsenic concentrations from both stations were plotted and included in the windsorized mean calculation. The lower concentrations from both samples could also have been plotted. However, considering the size of the data set used in obtaining the windsorized mean, the mean concentration would have been essentially no different. Furthermore, since the risk assessment reports risks to plus or minus one order magnitude (as noted in the RI reports), adding the lower set of data would have had no significant effect on the risks estimated from the sediments in the lake.

The comment asserts that a different "testing procedure" was used when obtaining the two different arsenic results for stations El-3 and EL-5. This is not correct. The same analytical protocol was used for both samples. The divergent results from these samples support the conclusion that the sediments are highly variable.

Page 12, Para. 5 through Page 13, Para. 1 (Item D)

The ATSDR report has been discussed previously.

Page 13, Para. 2 through Page 14, Para. 1 (Item E)

The risk assessment was not used to "work back" and attain a predetermined cleanup level. Rather, the cleanup levels were determined after reviewing the results of the risk assessment.

The worst-case sediment risk calculation used the maximum sediment arsenic concentration found in the lake, 1273 ppm. EPA realizes that sediments are mobile within the lake, and that sediment arsenic concentrations are highly variable. Therefore, as a worst case, it is prudent to assume that the highest sediment arsenic concentration found in the lake may actually exist in the area of concern since (a) the contaminated sediments may be moved into the area of concern by natural processes, and (b) the highly contaminated sediments may already exist within the area of concern, but were not sampled. The mean sediment arsenic concentration was used for the most probable case risk estimate. This is appropriate since the sediments are mobile and may distribute to the area of concern.

Page 14, Para 2. (Item 4)

Speciation of arsenic was not performed in the RI/FS for the reasons noted in the referenced paragraph, namely that there are significant experimental and analytical uncertainties in determining the speciation, and the uncertainty in the metabolism of the various arsenic compounds. The conservatism of this approach in the risk assessment was clearly stated in the report.

There is no corroborated data that indicates that there is another source of arsenic into Union Lake.

The form of arsenic in the lake, as this relates to tracing the source, was discussed in previous responses.

Page 14, Para. 3 (Item 5)

Sediment lead analyses in the Maurice River upstream and downstream of the confluence with the Parvin/Tarkiln Branch show no increase in the lead concentration downstream from the confluence. Downstream from the confluence the lead concentration is 14 ppm. Upstream from the confluence, the lead concentration ranges from 2 to 33 ppm, averaging approximately 22 ppm. If the alleged source of lead exists, it is not apparent from the sediment data.

There is no corroboration of another source of arsenic into the Maurice River basin besides the Vineland Chemical Company site.

Page 14, Para. 4 (Item 6)

The FS reports clearly state the basis for considering the soils, sediments, and groundwater from the Vineland Chemical Company as listed hazardous wastes. The EP Toxicity Test referred to in the comment is an applicable test to classify wastes as hazardous or nonhazardous for disposal purposes, but is not used to determine the need for remediation.

The comment incorrectly asserts that arsenic is tightly bound to the soils at the Vineland Chemical Company Plant site. Treatability tests presented in the Plant Site RI report showed that the arsenic was easily leached with a water extraction.

The soils and sediments are eligible for remediation under CERCLA since they pose a present public health risk and/or environmental risk and are within the area of contamination of a Superfund site. The overall protection of human health and the environment is the central mandate of CERCLA.

Page 14, Para. 5 to Page 15, Para 1

EPA Headquarters personnel determined that the soils, sediments, and groundwater at the Vineland Chemical Company site were all the listed hazardous waste K 031 because they were contaminated by this listed waste, consistent with the requirements of 40 CFR 261.32. The conditions under which these materials must be treated and disposed of to be considered nonhazardous wastes are discussed in detail in the FS reports.

The EPA never determined that "the EP Toxicity Test was an appropriate measure to be used to determine risks and hazards" as the comment suggests. EPA policy is to evaluate the need for remediation via a risk assessment, which is not dependent on an EP Toxicity Test.

Page 15, Para. 2 (Item 7)

The water arsenic concentration of 0.05 mg/l is the Federal Safe Drinking Water Standard for arsenic, and as such is an ARAR which EPA correctly used to establish cleanup goals for various waste streams and contaminated media.

Page 15, Para. 3

The application of the VHS model based upon the target concentration of 0.05 ppm arsenic was correct, since this is the Federal Safe Drinking Water Standard for arsenic.

Since the soils and sediments are considered the listed hazardous waste K 031, the delisting criterion of 5 ppm arsenic in an EP Toxicity Test is not applicable. The delisting criteria discussed in the FS reports are appropriate for these listed wastes.

TECHNICAL DEFICIENCIES

Page 1, Item 1 - The information supplied to EPA by the Vineland Chemical Company previously was that the operations at this plant began in 1949.

Page 1, Item 2 - The characterization of sediments as K 031 was appropriately done under the "mixed in" rules cited in the FS reports (40 CFR 261.32).

Page 1, Item 3 - The Vineland Chemical Company Superfund site is considered the plant site itself, as well as the areal extent of contamination resulting from the plant site.

Page 1, Item 4 - EPA assumed responsibility for the RI/FS after the Vineland Chemical Company failed to produce an acceptable Work Plan for the RI/FS in accordance with the scope and standards of EPA superfund RI/FS projects.

Page 1, Item 5 - The system was originally designed to produce between 2,000 and 5,000 gallons per day of process water, according to information supplied to EPA by the Vineland Chemical Company. The RI/FS reports clearly stated that the water system at the plant was later modified such that all process water would be included as inherent moisture in the product, again as reported by the Vineland Chemical Company.

Page 2, Item 1 - EPA believes that the wording in the RI/FS accurately summarizes the decision.

Page 2, Item 2 - The comment correctly points out that the Administrative Consent Order was dated December 21, 1981, not December 22, 1981 as indicated in the text. This has no effect on the RI/FS.

Page 2, Item 3 - EPA believes that the wording in the RI/FS accurately summarizes the decision.

Page 3, Item 1 - EPA believes that the wording in the RI/FS accurately summarizes the site history.

Page 3, Item 2 - The EPA believes that the discussions of the potential impacts of contamination to drinking water supplies are adequately and accurately presented in the RI/FS texts.

Page 3, Item 3 - The Vineland Chemical Company was shown to be the only source of arsenic into the basin. No arsenic was detected downstream from the alleged other source of arsenic discussed in this comment. The characterization of the sediments in the Union Lake as the listed hazardous waste K 031 is based on an appropriate application of the requirements in 40 CFR 261.32, as discussed in the FS reports.

If you have any further questions or comments, please contact me at the address below:

Ferdinand Cataneo, Ph.D, P.E.
Remedial Project Manager
U.S. Environmental Protection Agency
26 Federal Plaza
New York, NY 10278

Sincerely yours,

Ferdinand C. Cataneo

Ferdinand Cataneo
Remedial Project Manager

APPENDIX A

EPA'S PROPOSED PLAN FOR REMEDIAL ACTION AT VINELAND CHEMICAL COMPANY SITE

Proposed Plan
For
Vineland Chemical Company, Inc. Site

Prepared by
U.S. Environmental Protection Agency
July 1989

FOREWORD

The U.S. Environmental Protection Agency (EPA) recently issued three draft Remedial Investigation/Feasibility Study reports for public review, dated June 1989. These reports cover the three study areas of the Vineland Chemical Company, Inc. Superfund Site

As required by Section 117 of the Comprehensive Environmental Response, Compensation and Liability Act, as amended (CERCLA), EPA is hereby presenting the Proposed Plan for remediation of this site. A public meeting will be held to discuss the RI/FS and the Proposed Plan on July 18, 1989 beginning at 7:00 pm in the Vineland City Hall. A Public Availability session will be held on July 19, 1989 from 9:00 am to 1:00 pm to provide interested parties an opportunity to discuss the plan on an individual basis.

EPA solicits comments to the draft RI/FS reports and to this Proposed Plan. The public comment period will extend until August 1, 1989. After the specified comment period, EPA will develop a final plan for the remediation of the site which will be based on full consideration of all relevant information, including public comments. EPA will document the final plan in a Record of Decision which will include a response to each of the significant comments, criticisms, and other information submitted by the public during the review of the Proposed Plan or draft RI/FS reports.

Comments should be addressed to:

Dr. Ferdinand Cataneo
U. S. Environmental Protection Agency
Room 759
26 Federal Plaza
New York, New York 10278

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Section 1
INTRODUCTION

This proposed plan is published in accordance with Section 117(a) of the Comprehensive Environmental Response, Compensation and Liability Act, as amended (CERCLA). It describes the remedial alternatives which were analyzed for the Vineland Chemical Company, Inc. Superfund site and identifies and explains the preliminary decisions on preferred alternatives. These preliminary decisions are based on information in the draft Remedial Investigation (RI) and Feasibility Study (FS) reports. Key information from the RI/FS reports is highlighted here. However, for additional detail, the RI/FS reports should be consulted.

The draft RI/FS reports are being distributed along with this document to solicit public involvement in selecting the remedies.

SITE DESCRIPTION

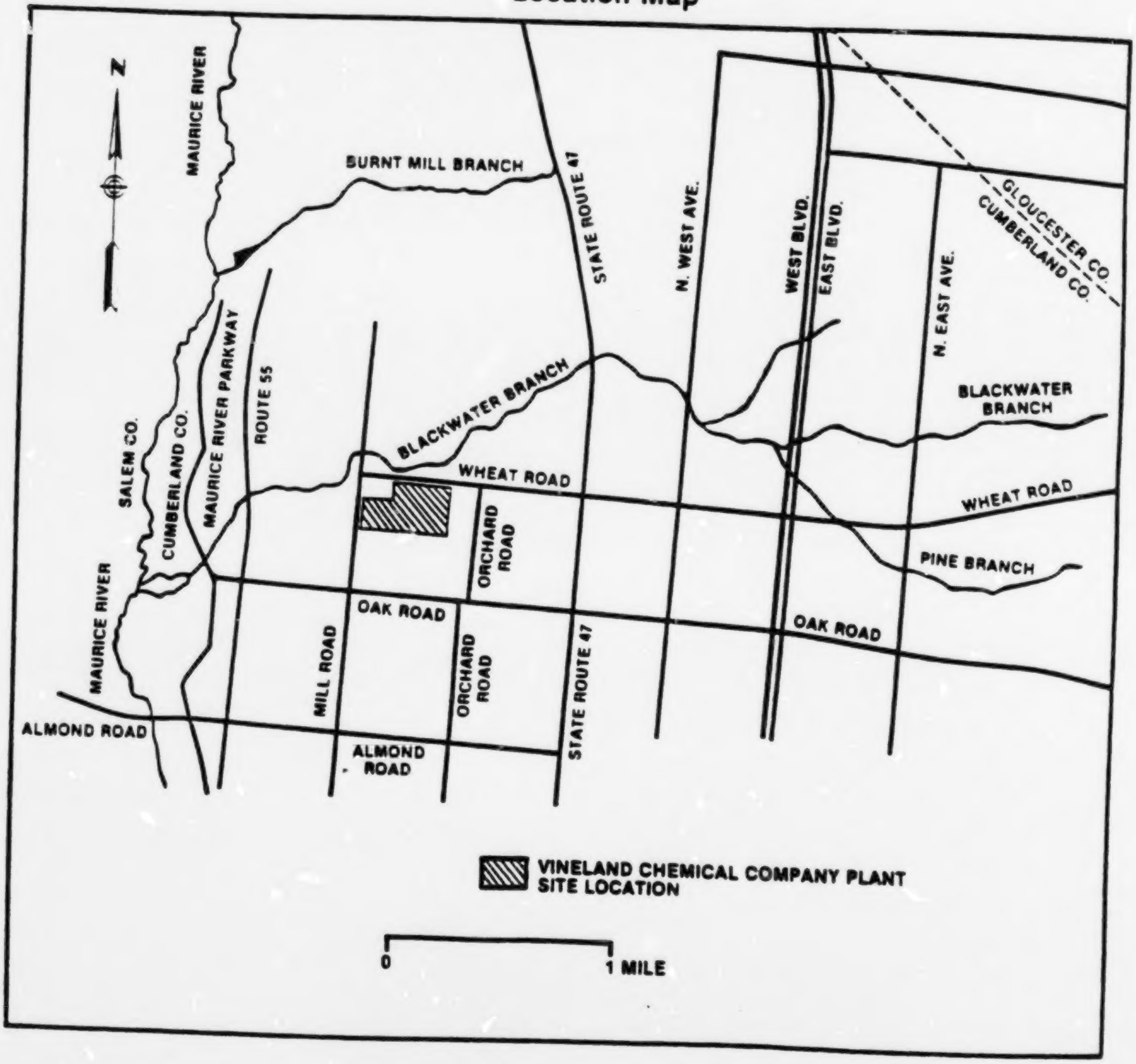
The Vineland Chemical Co., Inc. plant is located in the northwest corner of the City of Vineland in Cumberland County, New Jersey. Situated alongside the Blackwater Branch, a tributary of the Maurice River upstream of Union Lake, the plant has produced organic arsenical and other agricultural chemicals since 1949. Figure 1 shows a map of the local area.

Improper plant practices, which have been corrected through enforcement actions by the New Jersey Department of Environmental Protection (NJDEP), have released contaminants to the environment. Arsenic contamination now extends from the plant soils and underlying groundwater, to the Maurice River and Union Lake downstream of the plant to the Delaware Bay. The site was placed on the National Priorities List in 1984. The U.S. Environmental Protection Agency (EPA) is the lead agency, and NJDEP is the support agency for remedial activities at the site.

In accordance with CERCLA, the scope of the RI/FS includes the plant site, the areal extent of contamination, and all related public health and environmental impacts. Thus, in addition to the plant site, the RI and FS reports deal with the Blackwater Branch from the plant to its confluence with the Maurice River, the Maurice River from the Blackwater Branch to Union Lake, and Union Lake. Testing of the Maurice River below Union Lake to the Delaware Bay did not indicate the need for further investigation.

The RI/FS was conducted to identify the types, quantities, and locations of contaminants, and to develop ways to correct the problems posed by the contaminants. The RI/FS indicated the following contamination problems:

Figure 1
Vineland Chemical Company, Inc. Site Location Map


N
MAURICE RIVER
BURNT MILL BRANCH
STATE ROUTE 47
N. WEST AVE.
WEST BLVD.
EAST BLVD.
N. EAST AVE.
GLOUCESTER CO.
CUMBERLAND CO.
SALEM CO.
CUMBERLAND CO.
MAURICE RIVER PARKWAY
ROUTE 55
BLACKWATER BRANCH
BLACKWATER BRANCH
WHEAT ROAD
WHEAT ROAD
ORCHARD ROAD
PINE BRANCH
MAURICE RIVER
OAK ROAD
OAK ROAD
MILL ROAD
ORCHARD ROAD
STATE ROUTE 47
ALMOND ROAD
ALMOND ROAD
▨ VINELAND CHEMICAL COMPANY PLANT SITE LOCATION
0
1 MILE

169

- **Vineland Chemical Plant site**
  - on-site soils above the water table are substantially contaminated with arsenic in certain localized areas.
  - the shallow groundwater beneath the site is contaminated with arsenic, and contaminated to a lesser degree with cadmium and trichloroethylene (TCE).
- **River Areas**
  - localized sediments and surface water in the Blackwater Branch have elevated arsenic concentrations downstream of the plant site, while having low to non-detectable levels upstream of the plant.
  - localized sediments and surface water in the Maurice River below, but not above, its confluence with the Blackwater Branch have elevated arsenic concentrations.
  - about six metric tons of arsenic per year currently enters the Blackwater Branch with the plant groundwater.
- **Union Lake**
  - Arsenic contamination in sediment is widespread in much of the lake. Contamination is surficial (up to 1 foot in sediment depth) with highly variable concentrations (undetected to elevated levels). Surface water has elevated arsenic concentrations.

SCOPE OF OPERABLE UNITS

As is true with many Superfund sites, the Vineland Chemical site is complex with multiple contamination areas, namely, the plant site, the Maurice River, and Union Lake. This complexity, and the interrelationship of the areas, necessitates that the cleanup be done in discrete phases which are called operable units. The phases or operable units are planned for sequential execution beginning with the plant site. Once the arsenic contaminated groundwater from the plant site entering the Blackwater Branch is stopped, the cleanup of the Blackwater Branch itself can begin, to be followed by cleanup of the upper Maurice River, as required, and finally Union Lake. The operable units for the Vineland Chemical site are:

1) **Plant Site Source Control:** clean up the arsenic-contaminated soil, which is a continuing source of groundwater contamination and public health and environmental impacts. The target cleanup level is 20 milligrams per kilogram (mg/kg), which is the NJDEP soil action level for arsenic.

2) Plant Site Management of Migration: clean up the arsenic-contaminated underlying shallow groundwater and stop its migration to the Blackwater Branch. The groundwater cleanup goal is the drinking water standard, 0.05 milligrams per liter (mg/l), in the shallow aquifer.

3) River Areas Sediments: clean up those areas with unacceptably high arsenic concentrations, as required to mitigate public exposure and environmental impacts. The health based target cleanup level is 120 mg/kg, but is reduced to 20 mg/kg in more accessible areas such as Almond Beach and the Blackwater Branch floodplain.

4) Union Lake Sediments: clean up those areas with unacceptably high arsenic concentrations, as required to mitigate public exposure and environmental impacts. The health based target cleanup level is 120 mg/kg, but is reduced to 20 mg/kg in more accessible areas such as the Union Lake Beach, the Sailing and Tennis Club Beach, and residential areas.

The cleanup plan for the Maurice River Areas will be based in part on the results of a planned study of contaminated sediment movement, natural restoration rates, and surface water quality, after arsenic flow to the Blackwater Branch has been stopped.

An interim remediation of Union Lake is planned to protect the public from exposure to contaminated sediment, during a period of further study by EPA to determine the scope and nature of any required further action. This study will address the dynamics of sediment transport, to, within, and from the lake, and will address the effect of arsenic on biota.

Section 2
SUMMARY OF ALTERNATIVES

CERCLA mandates that the remedy which is selected for a site be protective of human health and the environment, cost-effective, and in accord with statutory requirements and the NCP. Permanent solutions to contamination problems are to be achieved wherever possible. The use of innovative technologies and on-site treatment is evaluated as a means to attain this goal.

In the RI/FS process, three categories of general response actions were considered for each operable unit: no action; containment; and treatment and disposal. A wide range of remedial technologies was identified and screened for use in each applicable response action to meet the cleanup objective of each operable unit. The technically feasible technologies were then grouped into potential remedial action alternatives, which were initially screened for effectiveness, implementability and cost. Those alternatives which passed the initial screening are highlighted here. The following provides a description of all of the remedial alternatives evaluated for the Vineland Chemical plant site, the river areas, and Union Lake. The numbers assigned to the alternatives correspond to those used in the FS reports.

o OPERABLE UNIT ONE (Plant Site Source Control)

PLANT SITE ALTERNATIVE SC-1: NO ACTION

The no action source control (SC) alternative provides the baseline against which other alternatives for the first operable unit may be compared. Potential public health risks would be reduced by limiting access to contaminated soils using restrictive fencing, warning signs, and educational programs. Natural flushing would reduce the exposure hazard and potential impacts on the groundwater over time. However, the contaminated soils would continue to pose a risk to public health and the environment for some years.

PLANT SITE ALTERNATIVE SC-2: MULTILAYER CAPPING SYSTEM

This is a containment action which would significantly reduce human health and environmental impacts. The capping system would consist of four layers: clay, geomembrane, sand, and a vegetative layer. However, the contaminated soil would remain on-site and untreated, requiring long-term management.

PLANT SITE ALTERNATIVE SC-3A: EXCAVATION/FIXATION/OFF-SITE NON-HAZARDOUS LANDFILL

This involves excavating and treating soil, contaminated by a listed (RCRA) arsenic waste, by fixation with cements and binders which reduce the mobility of contaminants to such degree that they are no longer hazardous. This means that after treatment the fixated product, could be "delisted". A treated waste may be "delisted," i.e., no longer considered to be a hazardous waste, if the treated waste no longer meets the criteria under which the waste was listed. Treated material would be deposited in an existing off-site non-hazardous landfill after delisting. This alternative would result in the removal of contaminated soils from the site.

PLANT SITE ALTERNATIVE SC-3B: EXCAVATION/FIXATION/ON-SITE NON-HAZARDOUS LANDFILL

This alternative is identical to SC-3A except that the landfill would be a new one built on the Vineland Chemical plant site property. This alternative would leave the treated soils on-site in the controlled environment of a landfill, and would require long-term maintenance and monitoring.

PLANT SITE ALTERNATIVE SC-3C: EXCAVATION/FIXATION/ON-SITE REDEPOSITION

This is the same as SC-3A except that the treated soils, which would no longer be hazardous, would be redeposited at their approximate original locations. Long-term monitoring would be required.

PLANT SITE ALTERNATIVE SC-4A: EXCAVATION/EXTRACTION/SOILS TO OFF-SITE NON-HAZARDOUS LANDFILL/OFF-SITE HAZARDOUS SLUDGE DISPOSAL

This involves excavating and treating contaminated soils by extraction with water to remove arsenic. The cleaned soils would be delisted and deposited in an existing off-site non-hazardous landfill. The arsenic-contaminated water would be treated to remove the arsenic. The sludge by-product of the water treatment would be sent to an existing off-site hazardous waste treatment and disposal facility. This alternative would result in the removal of contaminated soils from the plant site. The excavated areas would be restored using clean fill brought from an off-site location.

PLANT SITE ALTERNATIVE SC-4B: EXCAVATION/EXTRACTION/SOILS TO ON-SITE NON-HAZARDOUS LANDFILL/OFF-SITE HAZARDOUS SLUDGE DISPOSAL

This alternative is the same as SC-4A except that the cleaned soils would be deposited in a new non-hazardous landfill to be built on the Vineland Chemical site property. This would leave treated soils on-site in the controlled environment of a landfill, which would require long-term maintenance and monitoring.

PLANT SITE ALTERNATIVE SC-4C: EXCAVATION/EXTRACTION/ON-SITE REDEPOSITION OF SOILS/OFF-SITE HAZARDOUS SLUDGE DISPOSAL

This is the same as SC-4A except that the treated soils would be redeposited at their former locations. Since the treated soils would be delisted and no longer classified as waste, the site would be restored to normal use.

PLANT SITE ALTERNATIVE SC-5: IN SITU SOIL FLUSHING

This alternative involves flushing the contaminated soils with water. Some of the soils would first be excavated and consolidated. All of the contaminated soils would then be surrounded with a concrete berm and continuously flooded with water. The water used to extract the arsenic from the soil would percolate to the underlying groundwater aquifer where it would be pumped and treated. The groundwater treatment process would result in an arsenic sludge residue which would require off-site hazardous treatment and disposal.

PLANT SITE ALTERNATIVE SC-6: IN SITU SOLIDIFICATION/FIXATION OF UNSATURATED ZONE SOILS

This involves fixation in place, without excavation, using the same fixation process as Alternatives SC-3A, SC-3B, and SC-3C. Similar to Alternative SC-3C, the treated soils would remain at their former locations.

o OPERABLE UNIT TWO (Plant Site Management of Migration)

PLANT SITE ALTERNATIVE MOM-1: NO ACTION

This alternative provides the baseline against which other management of migration (MOM) alternatives for this second operable unit may be compared. It includes a long term monitoring program and an institutional control program to regulate the use of the aquifer. Natural flushing would reduce the potential health risks over time. However, the groundwater would continue to impact the Maurice River system, and pose human health risks requiring institutional controls on groundwater use.

PLANT SITE ALTERNATIVE MOM-2B: DOWNGRADIENT CAPTURE/TREATMENT/ REINJECTION

This alternative involves pumping groundwater from wells located close to the Blackwater Branch for downgradient capture, thereby minimizing migration to the Blackwater Branch. Pumping would be followed by treating the groundwater to the drinking water standards for arsenic, cadmium, and TCE by one of three treatment options to be described later. Treated water would be reinjected to the aquifer at an upgradient on-site location. This process would continue until the maximum groundwater arsenic plume concentration falls to 0.35 mg/l. At that concentration, groundwater flowing to the Blackwater Branch would not cause the instream standard of 0.05 mg/l to be violated, while the aquifer naturally flushes to meet the drinking water standard goal.

PLANT SITE ALTERNATIVE MOM-3A: DOWNGRADIENT CAPTURE AND SOURCE AREA PUMPING/TREATMENT/DISCHARGE TO THE MAURICE RIVER

This entails a combination of the downgradient pumping scheme of MOM-2B with additional pumping from extraction wells in the higher concentration source area to shorten the cleanup time. Treatment would be done as in MOM-2B, and the treated water would be discharged through a pipeline to the Maurice River.

PLANT SITE ALTERNATIVE MOM-3B: DOWNGRADIENT CAPTURE AND SOURCE AREA PUMPING/TREATMENT/REINJECTION

This alternative is the same as MOM-3A except that the treated water would be reinjected to the aquifer instead of being discharged to the Maurice River.

PLANT SITE ALTERNATIVE MOM-4A: SITE PUMPING/TREATMENT/REINJECTION/ DISCHARGE TO THE MAURICE RIVER

This involves the use of additional extraction wells in the high concentration source area to achieve a higher pumping rate than with the other MOM alternatives and significantly hastens the cleanup. Treated groundwater would be reinjected to the aquifer, at an upgradient on-site location, to the maximum extent practicable, with the remainder discharged to the Maurice River. As in the other MOM alternatives, the process would continue until the maximum groundwater arsenic plume concentration falls to 0.35 mg/l. At that concentration, groundwater flowing to the Blackwater Branch would not cause the instream standard of 0.05 mg/l to be violated, while the aquifer naturally flushes to meet the drinking water standard goal.

GROUNDWATER TREATMENT PROCESS OPTIONS

The following are treatment options for removing arsenic, cadmium and TCE.

TREATMENT PROCESS OPTION T1: CHEMICAL PRECIPITATION/AIR STRIPPING/VAPOR PHASE ACTIVATED CARBON ADSORPTION/LIQUID PHASE ACTIVATED ALUMINA ADSORPTION

TREATMENT PROCESS OPTION T2: CHEMICAL OXIDATION/CHEMICAL PRECIPITATION/ION EXCHANGE/LIQUID PHASE ACTIVATED CARBON ADSORPTION

TREATMENT PROCESS OPTION T3: UV-H202 OXIDATION/CHEMICAL PRECIPITATION

All three process options would clean the contaminated groundwater to the Federal Safe Drinking Water Standards for arsenic, cadmium, and TCE. Common to all three is a chemical precipitation step, which uses iron salts to remove the arsenic and cadmium from the water. The three options differ in the method used to remove the TCE, i.e., process T1 employs air stripping, while T2 uses carbon adsorption, and T3 uses oxidation to destroy the TCE. The three options also differ in the method used as a final step to "polish" the treated water and remove any residual arsenic or cadmium down to the Safe Drinking Water Standards.

o OPERABLE UNIT THREE (River Areas Sediments)

RIVER AREAS ALTERNATIVE 1: NO ACTION

This alternative provides the baseline against which other alternatives for the third operable unit may be compared. Potential public health risks from river sediments would be reduced by limiting access through sign posting and educational programs. Existing environmental contamination would continue, but could be decreased at a significant rate through natural processes, after the flow of arsenic from the plant site is stopped. Monitoring would be required to document the nature and scope of the natural processes.

RIVER AREAS ALTERNATIVE 2A: DREDGING/EXCAVATION/THICKENING/FIXATION/OFF-SITE NON-HAZARDOUS LANDFILL

This entails dredging submerged sediments in the Blackwater Branch and the Maurice River, and excavating exposed sediments in the Blackwater Branch floodplain. The dredged sediments would require thickening to remove excess water prior to fixation. Fixation would utilize cements and binders to reduce the mobility of the contained arsenic. The fixated product would be delisted and sent to an existing off-site non-hazardous landfill. Clean fill would be used to restore the floodplain to its original physical condition.

RIVER AREAS ALTERNATIVE 2B: DREDGING/EXCAVATION/THICKENING/FIXATION/ON-SITE NON-HAZARDOUS LANDFILL

This alternative is the same as Alternative 2A except that the disposal of treated sediments would be in a new landfill which would be built on the Vineland Chemical Company property.

RIVER AREAS ALTERNATIVE 3A: DREDGING/EXCAVATION/EXTRACTION/SEDIMENTS TO OFF-SITE NON-HAZARDOUS LANDFILL/OFF-SITE HAZARDOUS SLUDGE DISPOSAL

This uses the same dredging and excavation activities as Alternatives 2A and 2B. However, in place of fixation, extraction with water is used to remove arsenic from the contaminated sediments. The cleaned sediments, after delisting, would be sent to an existing non-hazardous landfill. Arsenic in the extraction water would be converted to a sludge during treatment and the sludge would be disposed in an existing off-site hazardous waste facility. The treated water would be returned to the river.

RIVER AREAS ALTERNATIVE 3B: DREDGING/EXCAVATION/EXTRACTION/ SEDIMENTS TO ON-SITE NON-HAZARDOUS LANDFILL/OFF-SITE HAZARDOUS SLUDGE DISPOSAL

This alternative is the same as 3A except that the cleaned and delisted sediments would be disposed of at a new non-hazardous landfill to be built on Vineland Chemical Company property.

RIVER AREAS ALTERNATIVE 3C:
DREDGING/EXCAVATION/EXTRACTION/FLOODPLAIN
DEPOSITION OF EXPOSED SEDIMENTS/PLANT SITE DEPOSITION OF RIVER SEDIMENTS/OFF-SITE HAZARDOUS SLUDGE DISPOSAL

This is the same as Alternative 3A except that the cleaned and delisted sediments would be disposed of as follows: floodplain sediments (non-submerged) would be redeposited as fill to replace remediated floodplain areas; and submerged sediments from the Blackwater Branch and the Maurice River would be deposited at the Vineland Chemical Company property in appropriate undeveloped areas.

o **OPERABLE UNIT FOUR (Union Lake Sediments)**

UNION LAKE ALTERNATIVE 1: NO ACTION

This alternative provides the baseline against which the other alternatives for the fourth operable unit may be compared. Potential public health risks from lake sediments would be reduced by sign posting and educational programs. Existing environmental contamination would continue, but could be decreased in the lake through natural processes, e.g., by dissolution, after the flow of arsenic from the plant site is stopped, or by sediment resuspension and transport. Monitoring would be required.

UNION LAKE ALTERNATIVE 2A: REMOVAL/FIXATION/OFF-SITE NON-HAZARDOUS LANDFILL

This entails dredging and/or excavating contaminated sediments in the lake's periphery, treating them by fixation with cements and binders to reduce arsenic mobility, and disposing of the treated sediments at an existing non-hazardous landfill. Excavated areas would be restored using clean fill, as would be done in all the alternatives except 3C and 5. Contamination in sediments in the deeper areas of the lake would remain, but could be decreased through natural processes, e.g., by dissolution, or by sediment redistribution, after the flow of arsenic from the plant site is stopped. Monitoring would be required prior to remedial action to gain an understanding of sediment redistribution as it would affect remediated areas, and sediment redistribution and arsenic dissolution as it would affect the natural restoration of Union Lake.

UNION LAKE ALTERNATIVE 2B: REMOVAL/FIXATION/ON-SITE NON-HAZARDOUS LANDFILL

This is the same as Alternative 2A except that the fixated and delisted sediments would be disposed of at a new non-hazardous landfill built on Vineland Chemical Company property.

UNION LAKE ALTERNATIVE 3A: REMOVAL/EXTRACTION/SEDIMENTS TO OFF-SITE NON-HAZARDOUS LANDFILL/OFF-SITE HAZARDOUS SLUDGE DISPOSAL

This uses the same sediment removal activities as Alternatives 2A and 2B. However, in place of fixation, extraction with water would be used to remove arsenic from the contaminated sediments. The cleaned sediments, after delisting, would be sent to an existing non-hazardous landfill. Arsenic in the extraction water would be converted to a sludge during treatment, and would be disposed of at an existing off-site hazardous waste facility. The treated water would be returned to the lake. Long-term monitoring would be required.

UNION LAKE ALTERNATIVE 3B: REMOVAL/EXTRACTION/SEDIMENTS TO ON-SITE NON-HAZARDOUS LANDFILL/OFF-SITE HAZARDOUS SLUDGE DISPOSAL

This alternative is the same as 3A except that the extracted sediments would be disposed of at a new non-hazardous landfill to be built on Vineland Chemical Company property.

UNION LAKE ALTERNATIVE 3C: REMOVAL/EXTRACTION/LAKE REDEPOSITION OF SEDIMENTS/OFF-SITE HAZARDOUS SLUDGE DISPOSAL

This alternative is the same as 3A except that the extracted sediments would be redeposited as fill for remediated areas in the lake. Long-term monitoring would be required.

UNION LAKE ALTERNATIVE 3D: REMOVAL/EXTRACTION/PLANT SITE DEPOSITION OF SEDIMENTS/OFF-SITE HAZARDOUS SLUDGE DISPOSAL

This alternative is the same as 3A except that the cleaned and delisted sediments would be deposited at the Vineland Chemical Company plant site in appropriate undeveloped areas.

UNION LAKE ALTERNATIVE 5: IN SITU SAND COVER

This provides a kind of containment by capping areas of contaminated sediments with a one foot layer of clean sand. This would significantly reduce human health and environmental impacts. However, the contaminated sediments would remain in the lake.

Section 3

PREFERRED ALTERNATIVES

After careful consideration of the remedial alternatives, EPA and NJDEP have made preliminary choices of preferred alternatives for the four operable units. These choices, which could change as a result of public comments, are as follows:

o OPERABLE UNIT ONE (Plant Site Source Control)

The preferred alternative is Alternative SC-5, In Situ Soil Flushing. This alternative would accelerate natural soil flushing in four active zones, which would be bermed and flooded to provide continuous water flushing. The flushing water would dissolve and carry the arsenic from the soil to the underlying groundwater. Groundwater pumping and treatment, which must also be implemented at the plant site, will convert the arsenic to a sludge for off-site hazardous treatment and disposal.

Plant site remediation also includes cleaning and closing of the storage buildings and the two lined RCRA surface impoundments.

o OPERABLE UNIT TWO (Plant Site Management of Migration)

The preferred alternative for the groundwater is MOM 4A. This alternative involves pumping groundwater at a high flow rate from a larger number of wells to be located in high contamination zones in addition to downgradient capture wells. The preferred treatment alternative is T2, which would remove the contaminants, i.e., arsenic, cadmium, and TCE to meet the drinking water standards for the lowest cost. After treatment to drinking water standards, the treated water would be recharged to the aquifer at the maximum rate practicable while the remainder is discharged to the river. Some of the treated water would provide the flushing water required for Operable Unit One, In Situ Soil Flushing (SC-5).

o OPERABLE UNIT THREE (River Areas Sediments)

The preferred alternative is 3C. Operations on the exposed Blackwater Branch floodplain sediments, which would begin soon after arsenic flow in the groundwater to the Blackwater Branch is stopped, entails excavation of "hot spots", extraction with water to remove arsenic from the sediments, and redeposition of treated sediments in the floodplain. At about the same time, contaminated submerged sediments in the Blackwater Branch would be dredged, extracted with water to remove arsenic, and then deposited in appropriate undeveloped areas of the Vineland Chemical Company plant site. After extracting arsenic from the sediments, the arsenic-laden water would be treated to remove the arsenic in the form of a sludge, which would be transported to an existing off-site hazardous waste facility for treatment and

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disposal.

Contamination in the submerged sediments of the Maurice River is expected to be significantly reduced by the natural scouring and dissolution effects of the river, over time, especially after arsenic flow from the plant site is stopped. Therefore, remediation of these submerged sediments would occur, if necessary, beginning three years after the arsenic flow from the plant site has stopped. Remediation would entail dredging, extraction with water to remove arsenic from the sediments, and deposition of the cleaned sediments in undeveloped areas of the plant site.

o OPERABLE UNIT FOUR (Union Lake Sediments)

The preferred alternative is 3C. This involves lowering the lake's water level, dredging, and excavating those portions of the lake's periphery which contain arsenic at concentrations that present an unacceptable exposure risk to the public.

In the high access public areas, which include the Public Beach and the Tennis and Sailing Club, "hot spots" with arsenic concentrations above 20 mg/kg would be remediated from the shoreline to a distance at which the lake water depth is 5 feet.

In the high access residential areas, "hot spots" above 20 mg/kg would be remediated to a minimum lake water depth of 2.5 feet, continuing to either a maximum distance of 150 feet from the shoreline, or a lake depth of 5 feet.

In the low access areas, e.g., the lake's western shore, "hot spots" above 120 mg/kg would be remediated to a minimum lake water depth of 2.5 feet, continuing to either a maximum distance of 150 feet from the shoreline or a lake depth of 5 feet.

The removed materials would be extracted with water to remove arsenic, and, after treatment, would be returned as fill for the remediated areas. The extraction water would be treated to convert the arsenic to a sludge for offsite hazardous treatment and disposal. The treated water would be returned to the lake.

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Section 4
RATIONALE FOR SELECTION

The nine criteria used to evaluate all remedial alternatives fall into four categories, namely, environmental/public health; compliance with cleanup standards; technical performance; and cost. In addition, the selected remedies should result in permanent solutions and should use treatment to the maximum extent practicable. The criteria are summarized below:

- Overall protection of human health and the environment addresses whether or not a remedy provides adequate protection and describes how risks posed through each pathway are eliminated, reduced or controlled through treatment, engineering controls, or institutional controls.

- Compliance with ARARs addresses whether or not a remedy will meet all of the applicable or relevant and appropriate requirements (ARARs) of Federal and State environmental statutes and/or provides a basis for a waiver.

- Long-term effectiveness refers to the ability of a remedy to maintain reliable protection of human health and the environment over time once cleanup goals have been met.

- Reduction of toxicity, mobility or volume is the anticipated performance of the remedy in terms of reducing the toxicity, mobility, or volume of the contaminants of concern in the environment.

- Short-term effectiveness addresses the period of time needed to achieve protection, and any adverse impacts on human health or the environment that may be posed during the construction and implementation period until cleanup goals are achieved.

- Implementability refers to the technical and administrative feasibility of implementing a remedy, including the availability of materials and services required to implement a particular option.

- Cost includes estimated capital and operation and maintenance costs of the remedy, and the net present worth cost.

- State Acceptance indicates whether, based on its review of the RI/FS and Proposed Plan, the State concurs in, opposes, or has no comment on the preferred alternative at the present time.

- Community Acceptance will be assessed in the Record of Decision following a review of the public comments received on the RI/FS report and the Proposed Plan.

The lead agency (EPA), together with the support agency (NJDEP), is required to select for each operable unit the remedial alternative which offers the best balance among the nine criteria. However, the selected remedy must meet the first two criteria: protection of human health and the environment, and compliance with ARARs unless a waiver is granted. The manner in which the preferred alternatives meet the criteria will be addressed briefly below. The State has indicated its concurrence with the preferred alternatives. Community comment and acceptance are being solicited at this time.

- **OPERABLE UNIT ONE (Plant Site Source Control)**

Flushing of contaminated soil in place would be effective in the long-term and permanent once the arsenic passes from the soil to the underlying groundwater and is subsequently removed. Fewer short-term impacts are expected than with competing alternatives because less excavation is required. Toxicity, mobility and volume of contaminants would be reduced once cleanup goals are met. Implementation is not complex, with further testing required prior to design. Cost is significantly lower than the other alternatives.

Competing alternatives are less attractive because they are not permanent (e.g., the containment alternative); less effective, (e.g., the fixation alternatives, which do not reduce toxicity or volume); less implementable due to the uncertainties of available off-site non-hazardous landfill sites; or more costly.

- **OPERABLE UNIT TWO (Plant Site Management of Migration)**

The use of groundwater pumping at a high flow rate (site pumping), with treatment to remove the contaminants, followed by reinjection and discharge, meets the criteria successfully. Long-term effectiveness and permanence would be achieved once the groundwater cleanup goal is reached. Toxicity, mobility and volume of the groundwater contaminants would be reduced, and the flow of arsenic to the Maurice River system would be stopped. Short-term effectiveness is achieved in that the short-term risks to on-site workers during installation and the time to halt groundwater flow to the Blackwater Branch after installation of the system are minimal.

Implementability is high in that reliable commercially available operations are employed for pumping and treatment. The cost for this alternative is significantly lower than that of the other alternatives, because the higher pumping rate results in the shortest time to finish the cleanup.

o **OPERABLE UNIT THREE (River Areas Sediments)**

For the exposed Blackwater Branch floodplain area, excavation of the contaminated zones followed by water extraction to remove arsenic, and redeposition of the cleaned sediment as fill material in its former locations meets the criteria. By removing the contaminants from the sediments to a safe level and disposing of contaminants at an off-site hazardous waste facility, this alternative would permanently protect human health and the environment, comply with ARARs, and reduce the toxicity, mobility and volume of contaminants in the river areas. The implementability would be simple because only commercially available equipment would be required, and the cleaned and delisted sediments are no longer regarded as a waste and present no threat to human health or the environment. This alternative is the least costly of the competing alternatives.

The submerged sediments contaminated above cleanup goals in the Blackwater Branch would be dredged. Any submerged sediments contaminated above cleanup goals remaining in the Maurice River above Union Lake would be dredged. The remediation of the submerged river sediments would begin after the three year period to assess the river's natural cleansing performance. The dredged material would be extracted with water to remove arsenic, and the cleaned sediments deposited in appropriate undeveloped areas of the plant site. Comments regarding the performance of this alternative relative to the criteria are the same as above regarding remediation of the exposed floodplain sediments.

However, owing to the greater ecological sensitivity of the river system to dredging as compared to dry excavation, an environmental assessment early in the design of the dredging operation would be required to assure acceptable short-term effectiveness. In addition, because disposal of the cleaned sediment as clean fill for the remediated river areas is not easily implementable, disposal would occur at the Vineland Chemical Company plant site where cost would be somewhat higher. Still, the overall cost is the lowest of the implementable alternatives.

The competing alternatives are less desirable because they are: less effective, e.g., the fixation alternatives, which do not reduce toxicity or volume; less implementable due to uncertain availability, e.g., the alternative employing existing non-hazardous off-site landfill disposal; or more costly.

o **OPERABLE UNIT FOUR (Union Lake Sediments)**

This will be an interim remedy to protect the public while further study is done. The interim remedy would begin after the submerged river sediments have been remediated (if this is deemed necessary after assessing the river's natural cleansing

performance), to avoid recontaminating areas of the lake. An interim remedy may be used in appropriate situations provided it does not result in any of the following: directly cause additional migration of contaminants; complicate the site cleanup; present an immediate threat to public health or the environment; or interfere with, preclude, or delay the final remedy, consistent with EPA's priorities for taking further action. All of the alternatives could be designed to meet the foregoing limitation except Alternative 5 (In Situ Sand Cover), which could complicate or delay any final remedy. Therefore, the remedy choice criteria were used to select the best interim remedy from the remaining alternatives.

Removal of sediments in Union Lake's periphery containing arsenic at levels above cleanup goals, followed by extraction with water to remove arsenic, and returning of the cleaned sediments to their former locations in the lake, would meet remedy choice criteria. By reducing the sediment arsenic concentration to an acceptable level, human health would be protected. The remedy would reduce arsenic toxicity, mobility, and volume in the lake. Redistribution of the remaining arsenic contaminated sediments is possible. In addition, the remaining arsenic contaminated sediments may be mitigated by natural processes, such as sediment resuspension and transport, or arsenic dissolution, especially after the flow of arsenic from the plant site is stopped. Long-term monitoring is required. Short-term effectiveness is high with minimal and controllable adverse impacts during removal and redeposition. To ensure the controllability of these impacts, an environmental assessment of the excavation and redeposition steps would be conducted early in the design process. This alternative is simple to implement since it uses available commercial equipment and reliable technology. Cost for this alternative is lowest among those which use treatment.

Competing alternatives are less attractive because they are: less effective, e.g., the fixation alternatives, which do not reduce toxicity or volume; less implementable due to uncertain availability, e.g., the alternative employing existing non-hazardous off-site landfill disposal; or more costly.

In summary, at this time, the preferred alternative for each of the four operable units is believed to provide the best balance among the alternatives with respect to the criteria used to evaluate remedies. Based on the information available at this time, EPA and NJDEP believe the preferred alternatives would be protective, would attain ARARs, would use permanent solutions and treatment technologies to the maximum extent practible and would be cost-effective.

Section 5
COMMUNITY ROLE IN THE SELECTION PROCESS

EPA relies on public participation to ensure that the remedies selected at each Superfund site meet the needs of the local community in addition to being an effective solution to the problem. To this end, this Proposed Plan is being distributed to the public during the 30-day public comment period which will end on August 1, 1989. Written and oral comments on the Proposed Plan and on the RI/FS reports will be documented in the Responsiveness Summary section of the Record of Decision.

All written comments should be submitted to:

Dr. Ferdinand Cataneo
Project Manager
U.S. Environmental Protection Agency
New Jersey Remedial Action Branch
26 Federal Plaza, Room 759
New York, New York 10278

After consideration of all comments, the final selections will be made and documented in the Record of Decision. A public meeting will be held at the Vineland City Hall on Tuesday evening, July 18, 1989 beginning at 7:00 p.m. to present the results of the RI/FS, and the proposed remedies. A public availability session will be held on Wednesday morning, July 19, 1989, from 9:00 a.m.-1:00 p.m. to allow one on one discussions with EPA about the RI/FS and the Proposed Plan.

FURTHER INFORMATION

Copies of the RI/FS reports, and all other documents comprising the site Administrative Record are available for review at:

Vineland City Hall
7th and Wood Streets
Vineland, NJ 08360
(609) 794-4060

Millville Public Library
210 Buck Street
Millville, NJ 08332
Reference Director:
Ms. Nancy Forester
(609) 825-7087

Vineland Public Library
1058 East Landis Ave
Vineland, NJ 08360
Reference Director:
Mr. Anthony Agnesino
(609) 794-4244

Millville City Hall
P.O. Box 609
Millville, NJ 08332
(609) 825-7000

Section 6

VINELAND CHEMICAL COMPANY, INC. SUPERFUND SITE

SUMMARY OF REMEDIAL ALTERNATIVES

REMEDIAL ALTERNATIVE	PRESENT WORTH COST ($1,000)	DURATION OF REMEDIAL ACTION (YEARS)	COMMENTS
■ OPERABLE UNIT ONE (PLANT SITE SOURCE CONTROL)			
SC-1: No Action	1,122	-	Inadequate to protect human health and the environment.
SC-2: Multilayer Capping System	7,232	1	Protective, but not permanent; contaminants remain on-site.
SC-3A: Excavation/ Fixation/Off-Site Non-Hazardous Landfill	62,937	1	Protective, permanent since contaminated soils removed; availability of landfill uncertain; delisting required; highest cost.
SC-3B: Excavation/ Fixation/On-Site Non-Hazardous Landfill	35,466	1	Protective; contaminants immobilized and placed in controlled environment; no reduction in toxicity or volume; site topography affected; delisting required; high relative cost.
SC-3C: Excavation/ Fixation/On-Site Redeposition	26,484	1	Protective; contaminants immobilized but remain on-site; no reduction in toxicity or volume; site topography affected; delisting required.
SC-4A: Excavation/ Extraction/Soils to Off-Site Non-Hazardous Landfill/Off-Site Hazardous Sludge Disposal	44,560	2	Protective; permanent; availability of landfill uncertain; delisting required; high relative cost.

REMEDIAL ALTERNATIVE	PRESENT WORTH COST ($1,000)	DURATION OF REMEDIAL ACTION (YEARS)	COMMENTS
SC-4B: Excavation/ Extraction/Soils to On-Site Non-Hazardous Landfill/Off-Site Hazardous Sludge Disposal	25,102	2	Protective; permanent; contaminated soil cleaned and placed in controlled environment; contaminants disposed off-site; site topography affected; delisting required.
SC-4C: Excavation/ Extraction/On-Site Redeposition of Soils/ Off-Site Hazardous Sludge Disposal	16, 934	2	Protective; permanent; contaminated soil cleaned; contaminants disposed off-site; site topography affected; delisting required.
SC-5: In Situ Soil Flushing	5,159	8	Recommended alternative for plant site soils. Protective; permanent; contaminated soil cleaned; contaminants removed from groundwater and transported off-site for disposal; longest time to remediate; low relative cost.
SC-6: In Situ Solidification/ Fixation of Unsaturated Zone Soils	24,872	2	Protective; contaminants immobilized but remain on-site; no reduction in toxicity or volume.
■ OPERABLE UNIT TWO (PLANT SITE MANAGEMENT OF MIGRATION)			
MOM-1: No Action	289	250	Inadequate to protect human health and the environment.
MOM-2B: Downgradient Capture/Treatment/ Reinjection	44,981	75	Minimizes migration to Blackwater Branch; treatment reduces toxicity; delisting required for treated water; longest time to remediate; highest cost.

REMEDIAL ALTERNATIVE	PRESENT WORTH COST ($1,000)	DURATION OF REMEDIAL ACTION (YEARS)	COMMENTS
MOM-3A: Downgradient Capture and Source Area Pumping/Treatment/ Discharge to the Maurice River	44,181	30	Minimizes migration to Blackwater Branch; treatment reduces toxicity; delisting required for treated water; long time to remediate; high relative cost.
MOM-3B: Downgradient Capture and Source Area Pumping/Treatment/ Reinjection	39,936	25	Minimizes migration to Blackwater Branch; treatment reduces toxicity; delisting required for treated water; shorter time to remediate; high relative cost though lower than MOM-3A.
MOM-4A: Site Pumping/ Treatment/Reinjection/ Discharge to the Maurice River	34,148	13	Recommended alternative for groundwater remediation. Minimizes migration to Blackwater Branch; treatment reduces toxicity; delisting required for treated water; shortest time and lowest cost to remediate.
▪ OPERABLE UNIT THREE (RIVER AREAS SEDIMENTS)			
ALTERNATIVE 1: No Action	874	-	Exposed sediments would remain a threat to human health and the environment. However, submerged sediment contamination expected to be significantly reduced by natural river flushing while human health could be protected by institutional controls.

REMEDIAL ALTERNATIVE	PRESENT WORTH COST ($1,000)	DURATION OF REMEDIAL ACTION (YEARS)	COMMENTS
ALTERNATIVE 2A: Dredging/Excavation/ Thickening/Fixation/ Off-Site Non-Hazardous Landfill	60,809	3	Protective unless remaining contamination re-collects; landfill availability uncertain; delisting required; highest cost.
ALTERNATIVE 2B: Dredging/Excavation/ Thickening/Fixation/ On-Site Non-Hazardous Landfill	43,666	3	Protective unless remaining contamination re-collects; contaminants immobilized and placed in controlled environment; no reduction in toxicity or volume; delisting required; high relative cost; plant site topography affected.
ALTERNATIVE 3A: Dredging/Excavation/ Extraction/Sediments to Off-Site Non-Hazardous Landfill/Off-Site Hazardous Sludge Disposal	24,710	3	Protective unless remaining contamination re-collects; landfill availability uncertain; delisting required; high relative cost.
ALTERNATIVE 3B: Dredging/Excavation/ Extraction/Sediments to On-Site Non-Hazardous Landfill/Off-Site Hazardous Sludge Disposal	16,875	3	Protective unless remaining contamination re-collects; delisting required; site topography affected.
ALTERNATIVE 3C: Dredging/Excavation/ Extraction/Floodplain Deposition of Exposed Sediments/Plant Site Deposition of River Sediments/Off-Site Hazardous Sludge Disposal	14,186	3	Recommended alternative for Blackwater Branch Floodplain remediation and River Areas sediments. Protective; permanent; contaminants disposed off-site; delisting required; low relative cost.

REMEDIAL ALTERNATIVE	PRESENT WORTH COST ($1,000)	DURATION OF REMEDIAL ACTION (YEARS)	COMMENTS
■ OPERABLE UNIT FOUR (UNION LAKE SEDIMENTS)			
ALTERNATIVE 1: No Action	874	-	Potential exposure to contaminated sediments remains. Protective if access to lake successfully restricted, and lake naturally flushes clean.
ALTERNATIVE 2A: Removal/Fixation/ Off-Site Non-Hazardous Landfill	68,840	3	Protective unless any remaining contamination re-distributes; availability of landfill uncertain; delisting required; highest cost.
ALTERNATIVE 2B: Removal/Fixation/ On-Site Non-Hazardous Landfill	49,006	3	Protective unless any remaining contamination re-distributes; contaminants immobilized and placed in controlled environment; no reduction in toxicity or volume; delisting required; plant site topography affected; high relative cost.
ALTERNATIVE 3A: Removal/Extraction/ Sediments to Off-Site Non-Hazardous Landfill/ Off-Site Hazardous Sludge Disposal	27,417	3	Protective unless any remaining contamination re-distributes; availability of landfill uncertain; delisting required; high relative cost.
ALTERNATIVE 3B: Removal/Extraction/ Sediments to On-Site Non-Hazardous Landfill/ Off-Site Hazardous Sludge Disposal	18,323	3	Protective unless any remaining contamination re-distributes; delisting required for on-site landfill; plant site topography affected; high relative cost.

REMEDIAL ALTERNATIVE	PRESENT WORTH COST ($1,000)	DURATION OF REMEDIAL ACTION (YEARS)	COMMENTS
ALTERNATIVE 3C: Removal/Extraction/ Lake Deposition of Sediments/Off-Site Hazardous Sludge Disposal	12,942	3	Recommended alternative for Union Lake. Protective unless remaining contamination re-distributes; delisting required; low cost.
ALTERNATIVE 3D:P Removal/Extraction/ Plant Site Deposition of Sediments/Off-Site Hazardous Sludge Disposal			Protective unless any remaining contamination re-distributes; delisting required; plant site topography affected; low relative cost.
ALTERNATIVE 5: In Situ Sand Covering	2,400	1	Contaminated sediments above action levels remain on-site; reliability of sand cover unknown although promising; no treatment; lowest cost.

APPENDIX B

EPA COMMUNITY RELATIONS ACTIVITIES AT THE VINELAND CHEMICAL COMPANY SITE

EPA COMMUNITY RELATIONS ACTIVITIES AT THE VINELAND CHEMICAL COMPANY SITE

ACTIVITY	DATE
EPA Community Relations Plan released to public	September 1986
Fact Sheet on the remedial investigation and feasibility study (RI/FS) released to the public	November 8, 1986
Public Meeting on RI/FS Work Plan held	December 1986
Public Meeting Summary released	April 1987
Proposed Plan released	June 30, 1989
Public Notice placed in local newspaper	July 12, 1989
Public Meeting held	July 18, 1989
Public Availability Session held	July 19, 1989
Public Comment Period conducted	July 1 - August 1, 1989

APPENDIX C

SIGN-IN SHEETS

The following Sign-In Sheets are from the Public Information Meeting held 7/18/89, and the Public Availability Session held 7/19/89 in Vineland City Hall, Vineland, New Jersey.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION II
JACOB K. JAVITS FEDERAL BUILDING
NEW YORK, NEW YORK 10278

MEETING ATTENDANCE SHEET

PLEASE SIGN

	NAME	ADDRESS & AFFILIATION
1.	[illegible]	NJDEP
2.	[illegible]	[illegible]
3.	[illegible]	[illegible]
4.	[illegible]	Millville
5.	[illegible]	Vineland
6.	[illegible]	1450 W. WHEAT RD VLD
7.	[illegible]	Millville
8.	[illegible]	1554 W. Wheat Rd. Vld. Resident Assoc. Cumberland Co. J. of Sportsmen's Clu
9.	[illegible]	2226 S [illegible] Rd VLD
10.	[illegible]	2323 E. Main St, Millville
11.	Michael Pantalone	[illegible] S Main Rd Vineland City Counci
12.	[illegible]	[illegible] Robin Rd [illegible]
13.	[illegible]	NJDEP
14.	Ray Novak	Ebasco
16.	[illegible]	Ebasco
17.	[illegible]	NJDEP
18.	Rocky [illegible]	[illegible] W. Sherman Ave. Vld.
19.	[illegible]	[illegible] Sherman Ave, Vld. [illegible]
20.	[illegible]	365 Dauphin Rd.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION II
JACOB K. JAVITS FEDERAL BUILDING
NEW YORK, NEW YORK 10278

MEETING ATTENDANCE SHEET

PLEASE SIGN

	NAME	ADDRESS & AFFILIATION
1.	[illegible] M [illegible]	WATER [illegible]
2.	[illegible]	" Millvile
3.	[illegible]	[illegible] & Water Millville
4.	Marjorie [illegible]	[illegible]
5.	[illegible]	617 QUAIL DR. MILLVILLE
6.	Joseph T. [illegible]	1944 [illegible] Rd Vineland [illegible]
7.	[illegible]	[illegible]06 GOLDFINCH LN MILLVILLE
8.	[illegible]	1306 [illegible]
9.	PETE Romanik	608 Whitall Ave. Millville
10.	Carl LAMPE	2580 W. GARDEN RD Vineland
11.	William [illegible]	26 Federal Plaza NY 10273
12.	Peter [illegible] Jr	27 Brittany Lane Millville NJ 08332
13.	melinda Dower, DEP	401 E State St Trenton NJ 08562
14.	Steve Anderson DEP	401 E State St. Trenton NJ 08025.
16.	Jill Moore DEP	" " "
17.	BOB [illegible]	608 QUAIL DR MILLVILLE, NJ
18.	Gladys [illegible]	189 S Orchard Rd
19.	Lawrence [illegible]	" "
20.	Sheila Conway	ICF 379 Thornall St. Edison, NJ

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION II
JACOB K. JAVITS FEDERAL BUILDING
NEW YORK, NEW YORK 10278

MEETING ATTENDANCE SHEET

PLEASE SIGN

	NAME	ADDRESS & AFFILIATION
1.	Jerry [illegible]	Greenblatt & [illegible]
2.	[illegible] Demiro	The Press of Atlantic City
3.	[illegible]	Daily Journal
4.	Russell D'[illegible]	Atlantic Co. [illegible]
5.	Earl [illegible]	21 [illegible]
6.	J. Mark	4165 Mays Landing Rd VLD
7.	Jane Morton Galetto	UNION LAKE SAILING CLUB CITIZENS UNITED TO PROTECT ... INC
8.	Adelaide K. [illegible]	Lake dweller
9.	Diann & Dave [illegible]	2402 [illegible] Mill Rd VLD
10.	Frank Cugino Jr.	700 S Mill Rd Vineland
11.	Carl Dannenberger	13 Euclid Ave Vineland N.J.
12.	[illegible]	529 MAURICE RIVER PKWY VINELD CUMBERLAND CONSERVATION LEAGUE
13.	Jack [illegible]	226 Landis Ave Vineland
14.	[illegible]	397 W. Weymouth Rd Vld.
16.	[illegible] Robinson	207 E. Oak VLD
17.		
18.		
19.		
20.		

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION II
JACOB K. JAVITS FEDERAL BUILDING
NEW YORK, NEW YORK 10278

MEETING ATTENDANCE SHEET

PLEASE SIGN

NAME **ADDRESS & AFFILIATION**

1. Nancy C Eisinelt 24 Arval Dr Millville Union Lake Sailing Clu
2. Glen Eisinelt "
3. ____________________
4. ____________________
5. ____________________
6. ____________________
7. ____________________
8. ____________________
9. ____________________
10. ____________________
11. ____________________
12. ____________________
13. ____________________
14. ____________________
16. ____________________
17. ____________________
18. ____________________
19. ____________________
20. ____________________

APPENDIX D

COMMENTS RECEIVED FROM THE VINELAND CHEMICAL COMPANY